ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 9, Issue 12 , December 2022

Increasing the regulatory values of consumers in improving the energy efficiency of enterprises

Urol Khoshimov, Shamsiddin Karaqulov

Docent, PhD degree, Tashkent State Technical University named after Islam Karimov, Olmazor, Tashkent, Uzbekistan.
PhD student, Institute of Energy Problems, Academy of Sciences of the Republic of Uzbekistan, Yashnobod, Tashkent, Uzbekistan.

ABSTRACT. As a result of the development of regulatory values of consumers of energy consumption of production enterprises, economy in energy consumption is achieved. Departments at the enterprise, the development of regulatory values of energy consumption in relation to the production of products of large energy consumers will have a positive effect on energy efficiency and production monitoring.

KEY WORDS: conveyor, pressing, motors, energy, electric welding, transformer.

I. INTRODUCTION

With the increasing demand for energy consumption in the world and the focus on economy issues, the emphasis is on the fact that energy supply planning begins with the normalization of energy consumption. Incentive scientific asoiu standards provide an opportunity to assess the degree of expropriation of working equipment, to identify unused reservations.
The norms should be based on the energetic characteristics of technological equipment and take into account the optimal modes of operation. Rationing the consumption of fuel, electricity and thermal energy is the establishment of planned measures for their consumption in production. According to each enterprise, in accordance with the concrete technologies for the production of products, individual norms of electricity and heat energy, fuel consumption are developed.
Today Uzbekistan is the only country in Central Asia that produces a full range of passenger and commercial vehicles. Currently, more than 85 enterprises operate in the field of auto industry in our country, and there is cooperation with more than 200 foreign enterprises and organizations in this area.

II. LITERATURE SURVEY

THE IMPORTANCE OF REGULATORY ENERGY EXPENDITURES TO INCREASE THE ENERGY EFFICIENCY OF ENTERPRISES

Given the experience of leading countries in the automotive industry, the condition for the creation and implementation of technological innovations in the practical activities of the most efficient automotive industry, companies create clusters to promote these new technologies will have a positive effect on increasing the efficiency of energy consumption.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 9, Issue 12 , December 2022

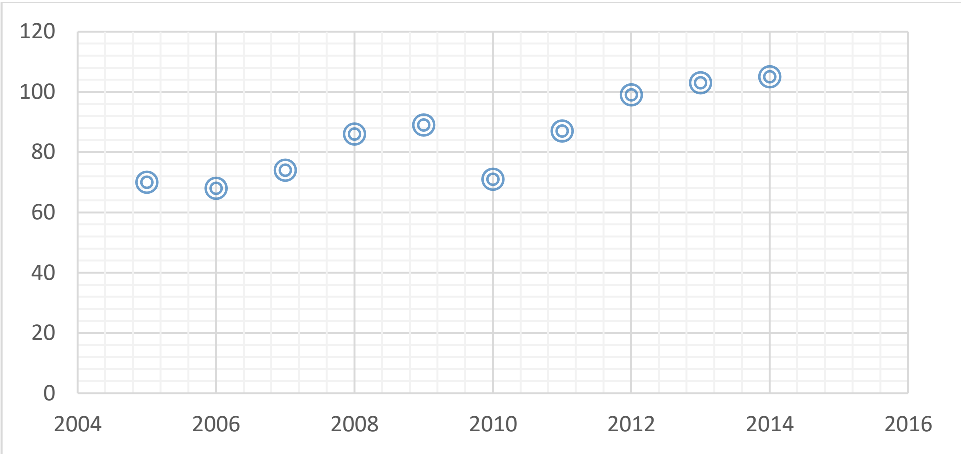

Fig 1. Dynamics of global research costs in the automotive industry, billion dollars [1].

From the main energy consumers of automobile manufacturing enterprises, the metal foundry department was calculated. The technological scheme of the metal casting department is shown in Figure 1.

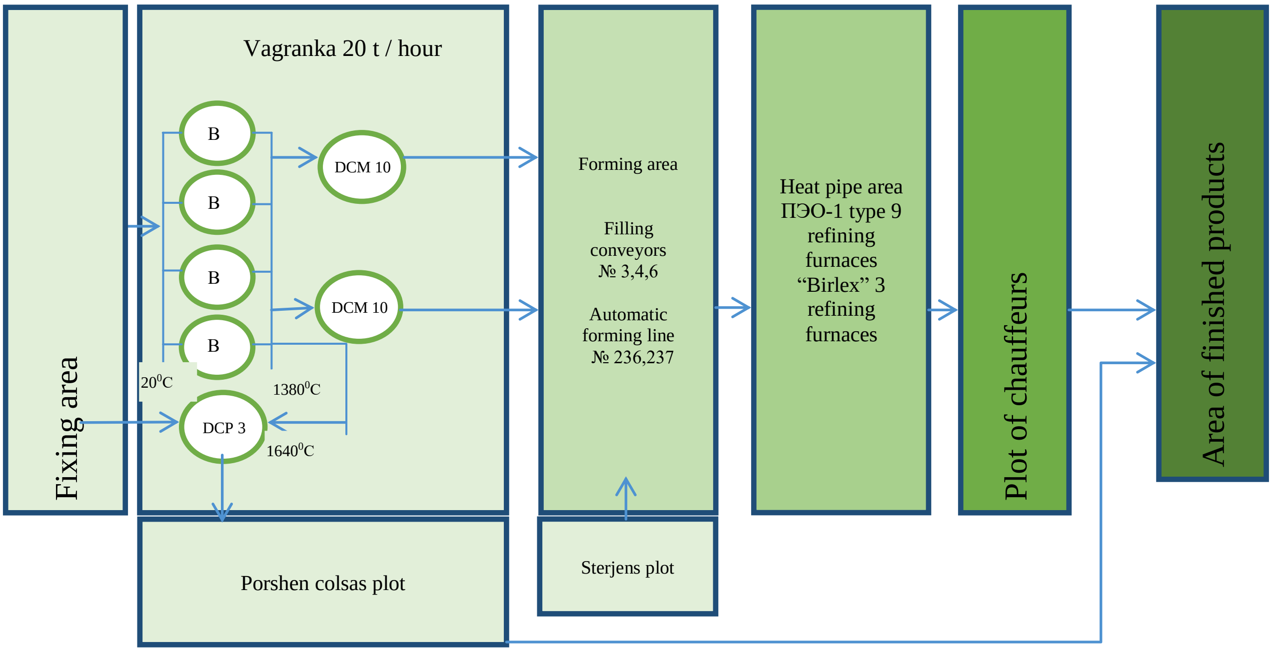

Fig 2. Scheme of technological relations of the metal casting department in the auto industry.

The balance of energy consumers in metal burn sections is shown in Figure 2

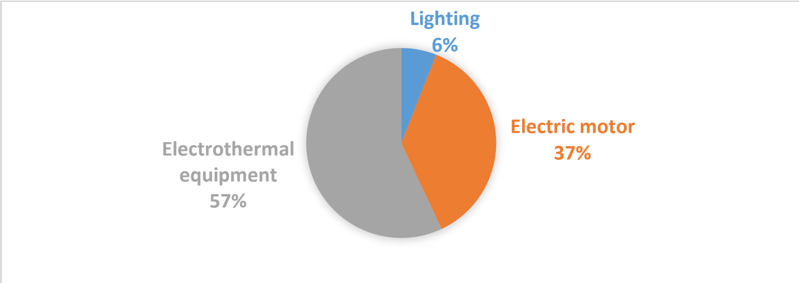

Fig 3. The ratio of the power of different electric consumers in the casting department

Thermal sections are designed for chemical thermal or thermal treatment of metal and non-metallic products. The main electrical consumers of these departments are chemical thermal processing units, salt baths and electric resistance furnaces. Thermal processing sections are usually made up of three sections: chemical thermal processing, mechanical processing, and conditioning sections with high frequency currents. The ratio of the power of different electrical consumers in thermal processing units is shown in Figure 3.

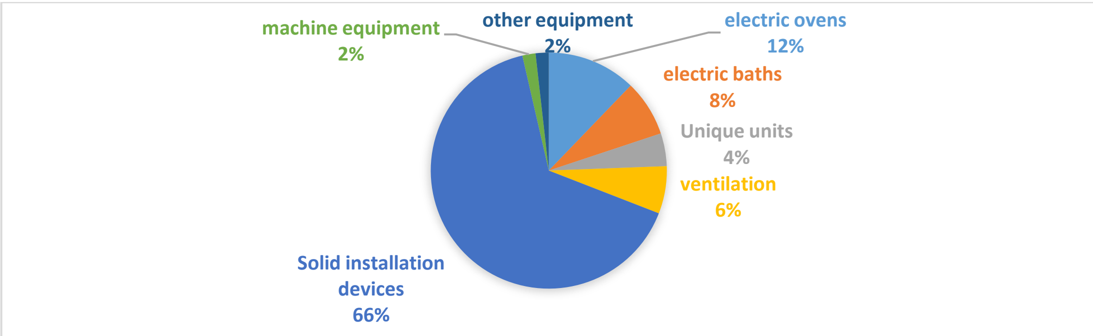

Fig 4. The ratio of the power of different electric consumers in the thermal processing department

The mechanical processing unit is designed for mechanical processing of metal and non-metal products, as well as assembly of individual rings and mechanisms.

The main electrical consumers of these departments are made up of various machine tools and automated lines. The power of the individual lathes is from 1.5 to 28 kW. reaches up to. In heavy mechanical engineering, the cumulative power of the machine tools goes to 1000 kW. In mass mechanical engineering, the average power of machine tools is 5-10 kW, and in large mechanical engineering-15-25 kW. The machine tools are supplied from variable voltage, 380 V. The mode of operation of electric consumers is continuous and reversible in a short time. The percentage ratio of the installed power of electrical consumers in the mechanical processing department is shown in Figure 4.

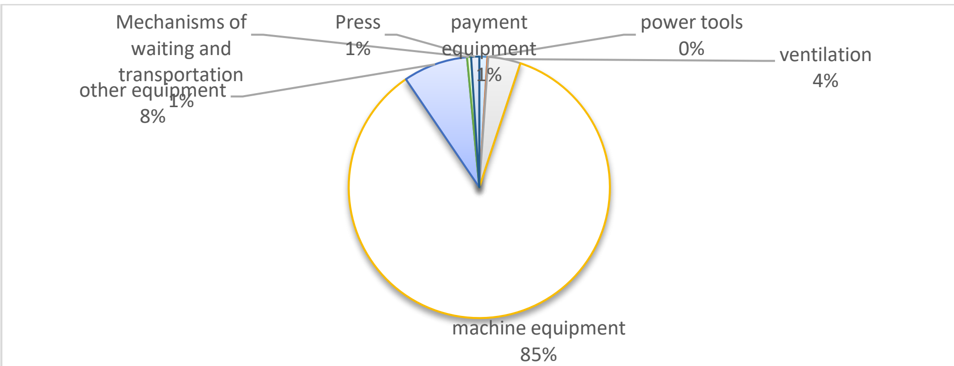

Fig 5. The ratio of the power of electrical consumers in the mechanical processing department

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 9, Issue 12 , December 2022

Pressing sections serve for stamping metal and plastic details. The main electrical consumers of these departments are presses. In the electrical and radio industry, in the manufacture of small parts in the watchmaking and other industries, electric magnetic presses are used, in which the movement of the sliders is carried out using an electric magnet of an invariant current. The provision of electric magnets is carried out using semiconductor exchangers.

The capacity of the drive in cold stamping cryoship presses is from 2 to 180 kW. In presses with boiling stamps - from 28 to 500 kW. The most powerful are hydropresses, the power of the hydropress motor at pumping stations is 250-1500 kW. The operation mode of the presses is reversible in a short time, the supply voltage is variable, 380, 6000 and 10000v. The second group of pressing departments includes various angles of metal transmission to electrical consumers and their laying devices in assemblies. The power of these electric consumers is 200 kW. The third group of pressing departments consists of metalworking equipment with a power of 1-55 kW, performing various tasks of electrical consumers. The fourth group includes electric consumers of general industrial purposes: fans, pumps, capacitors, transport-lifting devices with an electric motor power of 1.6-10 kW. The balance of energy consumers in the press department is shown in Figure 5.

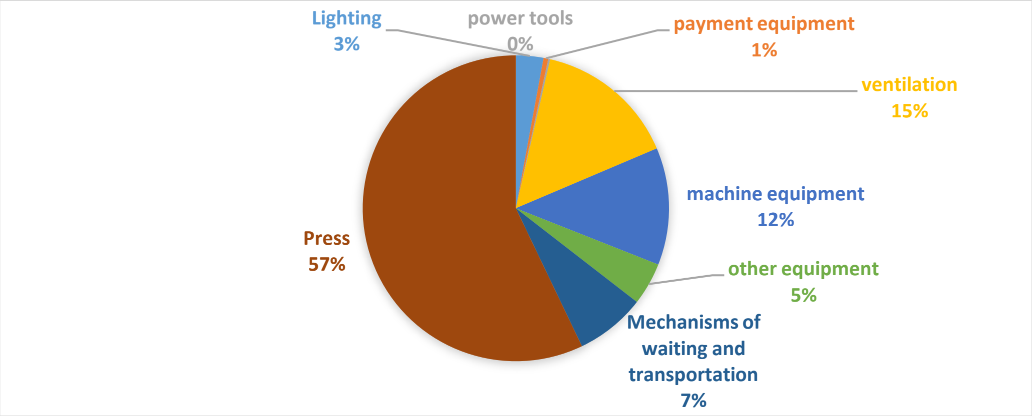

Fig 6. The ratio of electrical consumer power in the pressing section

Electric welding section. The largest energy consumer departments of mechanical engineering enterprises – these are the welding and assembly departments of large-sized products, sections for welding chains, etc. The main electrical consumers of these sections are electrical welding devices for ARC and contact welding. Arc welding uses invariant current source electric machine shifters, welding straighteners, alternating current single-phase and three-phase transformers.

Electric machine shifters are composed of an invariant current generator with a power of 4-55 kW and an asynchronous electric motor with a drive. The power of welding straighteners is 9-40 kVA, while those of welding transformers are 9-165 kVA. The voltage providing the arc welding device is variable, 380 V. The balance of electric energy consumers of the vaccination department is shown in Figure 6.

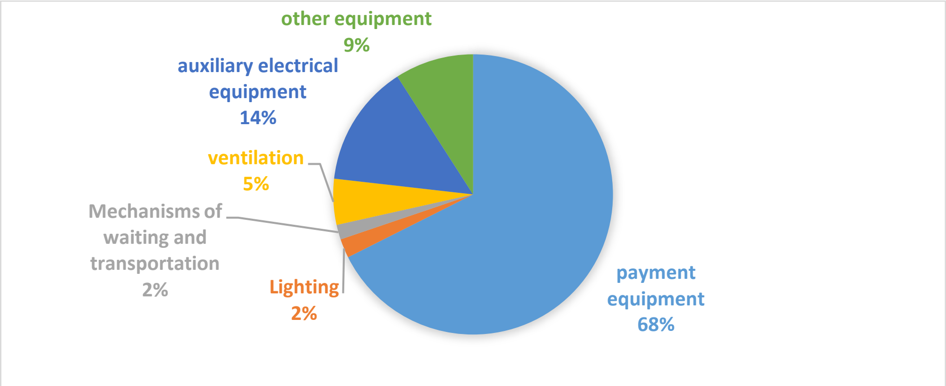

Fig 7. The ratio of electrical consumer power in the welding section.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 9, Issue 12 , December 2022

III. METHODOLOGY

Electricity consumption in the direction of the use of electricity of the technological equipment of the enterprise in which the study was carried out:

- to technological need;

- engine loading;

- provision of working conditions.

Also, in some enterprises, simplified expressions are used to determine the monthly and annual consumption of electricity:

$$W_{o.c} = \sum_{i=1}^{n} P_{\text{ўр.к}} \cdot k_{i.\text{ф}} \cdot \text{T}_{i.\text{о}}, \quad (1)$$

Here is $W_{o.c}$– monthly consumption of active electricity in the section, kW·s; n -the number of consumers of one type of electricity in the section, pieces; $P_{\text{ўр.к}}$ - the installed power of electrical consumers of Type i, kW; $k_{i.\text{ф}}$ - coefficient of use of electrical consumers of Type i; $\text{T}_{i.\text{о}}$- hours of operation of Type Electric consumers in a month, hours.

Based on the analysis of technological products produced by various departments of the machine-building enterprise, it is proposed to normalize electricity consumption for the following production units:

1) Casting units-kWh for 1 ton suitable casting;
2) in thermal units -1 kWh per product;
3) blacksmith stamping units-kWh per 1 product;
4) galvanic and painting sections-kWh per m^2 ;
5) mechanical sections-kWh per 1 product;
6) electric welding units-kWh per 1 product;
7) Assembly sections-kWh per 1 product;
8) production of compressed air,oxygen and other gaseous products-kWh per 1000 m^2;
9) water supply -1000 kWh per m^3;
10) repair, experience and other sections - kWh per 1 product.

For mechanical engineering enterprises, the calculation-analytical method is proposed as the main method for the development of technological and general production standards of the electricity consumption norm. In addition, experimental and computational-statistical methods can be used.

Calculation-analytical method of normalizing energy consumption for production units of enterprises of the automotive industry.

The total factory production standard of active electricity consumption W_{Σ} is determined by the following expression (kWh):

$$W_{\Sigma} = \sum_{i=0}^{n} W_{c.i} + W_s + \Delta W_z \quad (2)$$

where $W_{c.i}$ - by the general production standard of the i-th department, kW·h; W_s - the norm of electricity consumption for the auxiliary needs of the enterprise (compressed air, cold, oxygen, nitrogen production; water supply; production needs of auxiliary and service departments; operation of internal transport; outdoor lighting, etc.), kW·h; ΔW_z-losses in factory electrical networks (up to the measuring points of the department) and transformers, kw·h.

The norm of the total production consumption of active electricity by section $W_{\text{ц}}$ is determined by the following expression (kW·h):

$$W_c = W_{\text{т}} + W_{l.\text{c}} + \Delta W_{\text{ц}} \quad (3)$$

where $W_{\text{т}}$ is the electricity consumption for the technological needs of the department, kW·h; W_{lu} - electricity consumption for the auxiliary needs of the Department, kWh; $\Delta W_{\text{ц}}$-electrical losses in department networks and transformers, kW·h.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 9, Issue 12 , December 2022

The consumption of electricity for auxiliary needs consists of the sum of the following: lighting, ventilation and the consumption of electricity from other consumers (household and sanitary needs), which are not directly related to the technological process.
By the method of average loads, the consumption of electricity is determined by the following formula (kW·h):

$$\Delta W_{нj} = k_л \cdot k_к \cdot \Delta P_{ўр.} \cdot T_j \cdot k_ф^2 \quad (4)$$

here: $\Delta P_{ўр.}$ — power losses in the network in the average calculated load interval, kW; $k_л$ — the form coefficient of the network sum load graph in the calculated interval; $k_к$ -the coefficient that takes into account various configurations of the graphs of active and reactive loads of various deserts of the network, o.e.; T_j -j-th calculated interval duration, hours.

In the calculated interval, the form coefficient of the network sum load graph is determined by the following formula, o.e.:

$$k_ф^2 = \sum_{i=1}^{m} \frac{P_i^2 \cdot \Delta t_i}{P_{sp.}^2 \cdot T} \quad (5)$$

where: P_i^2–is the value of the load of the i–th degree graph with a duration Δt_i (hours), kW; m is the number of degrees of the graph in the calculated interval, PCs; $P_{sp.}^2$ -average network load at calculated interval, kW. The coefficient is taken to be equal to k_k=0.99.

In the calculated interval, it is allowed to determine the form coefficient of the charge graph with the following expression:

$$k_ф^2 = k_{фс}^2 \cdot k_{фм}^2 \cdot k_{фN}^2 \quad (6)$$

where: $k_{фn}$-form coefficient of the daily graph for control measurements, o.e.; $k_{фс}$-the form coefficient of the monthly graph in the transmission of electrical energy to the network (a graph with a value equal to the number of months in the calculated interval) is calculated by the following expression:

$$k_{фN}^2 = \sum_{i=1}^{m} \frac{W_{Mi}^2}{N_i \cdot W_{ўр.ой}^2} \quad (7)$$

where W_{Mi} is the electrical energy transmitted to the network in the i-th month at the calculated interval; W_{sm} - electric energy transmitted to the average monthly Network at the calculated interval. When calculating losses in a month $k_{фN}^2 = 1$.

Useful energy spent in direct processing, kW·h:

$$W_п = k_з \cdot \frac{P_н}{\eta_н} \cdot T_м \cdot \eta_{ст}(k_{зр}) \cdot \eta(k_{зр}) \ (8)$$

$k_з$ -load mode of the movable lathe power consumption of the chimney coefficient level, O.or.; $T_м$ -detail is taken as machine time, hours.

FIK function of the lathe from the load coefficient on the power in the engine shaft:

$$\eta_{ст}(k_{зр}) = \frac{5 \cdot \eta_{ст.н}}{5 \cdot \eta_{ст.н} + (\frac{3}{k_{зр}} + 2)(1 - \eta_{ст.н})} \quad (9)$$

where $\eta_{ст.н}$ - nominal useful work coefficient of the lathe, it is determined from the passport data of the equipment.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 9, Issue 12 , December 2022

In estimated calculations, the head movement is $\eta_{\text{ст.н}} = 0{,}7 \div 0{,}85$, while for machines in progressive motion it can be taken as $0{,}6 \div 0{,}7$.

It is presented according to the methodology for calculating monthly electricity consumption for the auxiliary needs of the department (lighting, ventilation and other consumers) and losses in department networks and transformers.

Calculation results:

$$W_{\text{lu.}} = 392871 \text{ kW} \cdot \text{h}; \; \Delta W = 39076 \text{ kW} \cdot \text{h}.$$

The monthly total electricity consumption norm by section is determined by the above expression as follows:

$$W_{\text{ц}} = W_{\text{т}} + W_{\text{lu.}} + \Delta W = 1302540 + 392871 + 39076 = 1734487 \text{ kW} \cdot \text{h}.$$

According to this section, the actual consumption of electricity is equal to 1868043 kW·h for the month under review (according to measurement results). The difference in relation to regulatory accounts is 7,7%.

IV. CONCLUSION

As a result of calculating and introducing into the work process the normative values of the electric energy consumption of the production enterprise, the control of the enterprise's energy consumption in relation to the manufactured products is achieved. The main result is the fact that with the help of the introduced method of rationing, the energy consumption of the enterprise has reached an efficiency of 7,7% per year.

REFERENCES

[1] The Automobile Industry Pocket Guide. European Automobile Manufacturers Association's report. Belgium, Brussels, 2015. – 78 p.
[2] Khoshimov F.A., Dzeventsky A.Ya., Ibragimov K.H. "Multivariate solution of problems of analysis, forecasting and rationing of power consumption at industrial enterprises producing heterogeneous products" – M.: // "Industrial power engineering", 2000, № 5.
[3] Khoshimov F.A., Dzeventsky A.Ya., Ibragimov K.H. "Method of analysis and calculation of energy intensity of products of enterprises using complex electric energy and energy of secondary energy carriers" – M.: // "Industrial power engineering", 2001, № 4.
[4] Khoshimov F.A. Methodological foundations for the development of energy saving management parameters. – T.: // International Scientific and Technical Conference "Innovation-2010", 2010 y.