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Reducing the mechanical waste of electric motors used at the enterprise

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ABSTRACT. When focusing on the issues of increased demand for energy consumption in the motors of devices and savings, there is widespread attention to the fact that the planning of energy supply should begin with the normalization of energy consumption. Stimulating scientifically based norms also allow you to assess the degree of exploitation of working equipment, identify and implement unused reserves. Measures to determine the regulatory level of energy consumption of the enterprise and control the consumption of electricity in this specified indicator, the continuous implementation of monitoring serves to prevent excessive waste.

KEY WORDS: conveyor, pressing, motor, energy, electric welding, transformer, energy-efficient.

I. INTRODUCTION

Extensive work on the effective use of energy is being carried out in the world. Including in Uzbekistan, it has developed an energy strategy that provides for the deployment of an energy efficiency program within the framework of a comprehensive energy saving policy. This program is aimed at creating the basic conditions for the rapid technological renewal of the energy industry, the development of modern processing plants and transport capacities, as well as the development of new, promising markets. When focusing on energy conservation issues at the enterprise, there is widespread attention to the fact that the planning of energy supply should begin with the normalization of energy consumption. Stimulating scientific-based norms are the exploitation of working equipment and its comparison with the newly developed types of the device being used. At the same time, the use of modern technologies to carry out and introduce an analysis of achievable results is considered a key issue in the era of energy shortages[1].

It should be based on the energetic characteristics of the motors of technological equipment and take into account the optimal modes of operation. The normalization of fuel, electricity and thermal energy consumption is the setting of planned measures for their consumption in production. In accordance with the concrete technologies of production of products in each enterprise, individual standards of electricity and thermal energy, fuel consumption are developed and carry out monitoring based on these standards.

Energy efficiency is achieved by increasing the energy efficiency of the devices supplied with compressors, fans, thermoplastic apparatus and a number of electric motors used in the production enterprise, preventing waste of electricity consumed by the product.

II.ANALYSIS OF THE CHANGE IN MECHANICAL WASTES OF ELECTRIC MOTORS

At designing series of energy-efficient motors, a way to improve energy efficiency motor is to reduce all types of losses, including mechanical losses. These losses amount to quite a significant proportion of permanent loss, which is practically independent of the load. Therefore, reducing mechanical losses is one of the tools for the design of energy-efficient motors[3].

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A number of methods are used to control the mechanical wastage of electric motors and achieve energy efficiency as a result of timely conduct of measures. These include monitoring the heat production level of electric motors, controlling the increase in electricity consumption at a given load, and other methods.

On the territory of the enterprise under study, the following buildings are located: an administrative building, a production building, warehouses and household buildings, a boiler room, a pumping station, a compressor station, etc. When the consumer divides the premises into main and auxiliary premises, it is divided into:

Main

- thermoplastic division

- assembly department

auxiliary departments

- compressor compartment

- pumping station

- boiler.

Electricity consumption in the direction of the use of electricity of the technological equipment of the enterprise under study:

- to the technological need;

- motor load;

- serves to ensure working conditions.

For technological purposes, electricity consumption-in the operation of technological devices, electrical erosion, electricity goes to statistical processes. Power consumption for Motor loading includes the power consumption of the main production units (various stoves, presses, etc.) include the electricity consumed by the units. Power consumption in the provision of working conditions includes electricity consumption, which does not apply to ventilation, capacitor operation, production and production, and goes to communications and control[2].

An analysis of electric motors at the enterprise revealed defects in the bearing parts of the motors when the reasons were analyzed, witnessing an increase in the consumption of electric energy as a result of an examination of motors producing excess noise. As a result of the replacement of bearings with a new one, a reduction in the consumption current of 1.5 kW motor 4.1 A to 3.4 A was achieved. The noise reduction that is dressing in the motor is reduced. In our conclusion, as a result of an increase in mechanical wastes in the motor, the waste of electrical energy will cause an increase of up to 20%.

Taking into account the above examples, the parameters of the devices used in the quarry are determined, which are controlled by determining the amount of electricity consumption and output received in a certain period after the current repairs. Based on the results obtained, the consumption and production efficiency of electrical energy are monitored, and the current repair of electrical drives is recommended if an increase in marginal deviations is observed. When performing these, it is required to carry out the following tasks:

- Development of the software and hardware complex “automated workplace of the engineer-energoauditor”.

- Energy inspection of the existing group of mechanical engineering enterprises analysis of the structure of technological processes, determination of the composition of electrical energy consumers and implementation along with electrical consumption research

- Analysis of methods for normalizing existing electricity consumption in mechanical engineering enterprises and their improvement, taking into account the actual operating modes of electricity consumers.

- Development of the concept of saving electricity and the methodology for the selection of energy-efficient technolgias and equipment[5].

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The table in which the devices of the enterprise, which are the main consumers of electricity, have a certain period of electricity consumption after operation is described below.

Table 1. 5-day results of electricity consumption by TPA machines

Name of the device	Calculation coefficient		Counter pointers		Difference of counter indicators	electricity consumption, kW * h
	current transformer (CT)	general	10.04.2023y. 14:00	15.04.2023y. 21:00		
1	2	4	5	6	7	8
ТПА-1050 LS №1	400/5	80	5352	5420,75	68,75	5500
ТПА-1050 LS №2	400/5	80	4820	4882,705	62,705	5016,4
ТПА-650 KM	400/5	80	3276	3300,92	24,92	1993,6
ТПА-650 LS №1	400/5	80	4196	4249,695	53,695	4295,6
ТПА-650 LS №2	400/5	80	4635	4691,296	56,296	4503,68
ТПА-850 LS	400/5	80	6468	6536,74	68,74	5499,2
ТПА-1300 LS	400/5	80	5946	6015,683	69,683	5574,64
Total electricity						32391,12

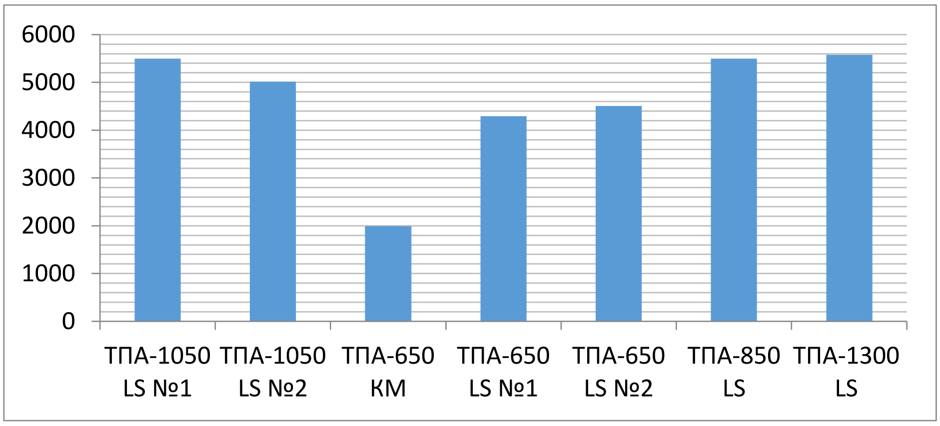

Figure 2. Basic electricity consumption 6 days of electricity consumption by consumers

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Table 2. 5-day production efficiency

№	Device name	Side / Clock:	The number of products released from 14:00 on 10.04.2023 to 21:00 on 15.04.2023.												Total:
		Date:	10.04.2023		11.04.2023		12.04.2023		13.04.2023		14.04.2023		15.04.2023		
1	TПA-650 KM	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name	A,B	B	B,C	C	C	C,D	D	D	D	D	D	A,B	
		LH+ RH	334	960	470	694	850	750	20	720	1056	1080	670	820	**4212**
		Energy consumption, kW*h	334	960	470	694	850	750	20	720	1056	1080	670	820	
2	TПA-650 LS №1	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name	F,D	F,D	N	Try. out	N	G	G	G	Try.out	N	N,H	H	
		LH+ RH	850	996	864	0	576	640	880	820	0	630	464	630	**3963**
		Energy consumption, kW*h	850	996	864		576	640	880	820	0	630	464	630	
3	TПA-650 LS №2	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name	L	L	L	L	L,O	O	O	O	O,M	L,N	E	O	
		LH+ RH	1120	1110	555	576	275	540	540	540	375	300	258	450	**5524**
		Energy consumption, kW*h	1120	1110	1110	1152	550	1080	1080	1080	750	600	516	900	
4	TПA-850 LS	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name	P,P1	P1,R	R	R	Q	Q	S	T	Try. out	Y	Y	Y	
		LH+ RH	864	830	1080	706	182	944	380	920	140	130	640	760	**3788**
		Energy consumption, kW*h	864	830	1080	706	182	944	380	920	140	130	640	760	
5	TПA-1050 LS №1	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name			F,H	F	X	X	X	X,Y	Y	Y	Y	Y	
		LH+ RH	0	0	804	1060	1008	1008	1008	752	810	1104	1134	1128	**4908**
		Energy consumption, kW*h			804	1060	1008	1008	1008	752	810	1104	1134	1128	
6	TПA-1050 LS №2	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name	A1	A1	A1	A1	A1,B 1	B1	B1	B1	B1	B1,C 1	C1,F	F	
		LH+ RH	180	144	1128	1044	800	1052	952	1020	768	822	776	1032	**4909**
		Energy consumption, kW*h	180	144	1128	1044	800	1152	952	1020	768	822	776	1032	
7	TПA-1300LS	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name	S	S	S	S	S	S	S	S	S	S			
		LH+ RH	80	720	864	710	834	870	792	710	864	324	0	0	**3384**
		Energy consumption, kW*h	80	720	864	710	834	870	792	710	864	324	0	0	
8	TПA-1300 WIZ	Shift	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	1-C	2-C	
		Product name	S	S	S	S,L	F	F,D1	F	D1	D1	D1	D1	D1	
		LH+ RH	602	742	768	768	550	1000	620	920	520	720	908	1060	**4589**
		Energy consumption, kW*h	602	742	768	768	550	1000	620	920	520	720	908	1060	

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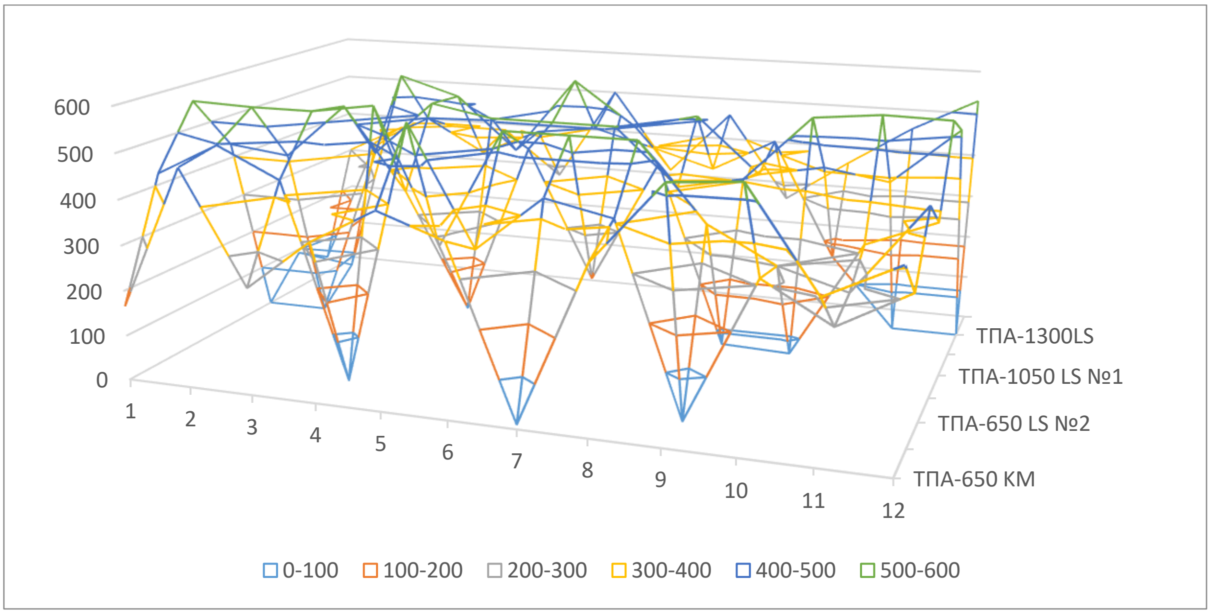

Figure 3. Number of production of the enterprise

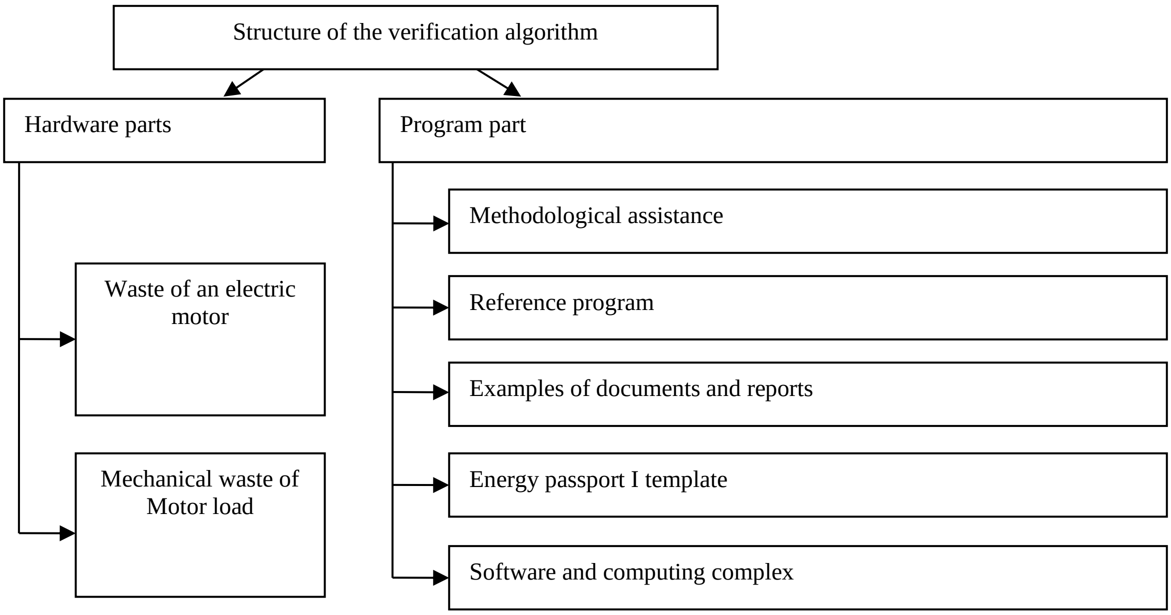

Figure 4. The verification algorithm of the device is the performance structure.

Through the algorithm for checking the energy consumption of the device, the passport obtained from the current verification is monitored for changes in parameters. As energy consumption exits the possible deviation range, the operator is given a signal of error. As a result of using this method on-line, energy conservation is carried out.

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As a result of the use of the verification algorithm, an increase in mechanical wastes is obtained, as a result of which the electricity consumption for errors is saved up to 1-3%. As a result of using the algorithm, material resource savings were found to increase by 15%. At the same time, it is of great importance to ensure the uniqueness of the production process.

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

$$W_{o.э.c} = \sum_{i=1}^{n} P_{ўр.қ} \cdot k_{i.ф} \cdot \text{Т}_{i.o}, \quad (1.1)$$

Where $W_{o.э.c}$ – monthly consumption of active electricity in Tsex, KW·s; n- is the number of consumers of one type of electricity in section, PCs; $P_{ўр.қ}$ - I-type electrical consumer installed capacity, kW; $k_{i.ф}$ - the coefficient of use of electric consumers of Type I; $\text{Т}_{i.o}$- - hours of operation of electricity consumers of the type in a month, hours.

As a result of an increase in the mechanical load, an increase in the amount of current consumed is observed. The computational expression for energy waste is defined as follows.

$$\text{P}_{EI} = m_1 \cdot I_1^2 \cdot r_1$$

where: m_1-is the number of phases, I_1-is the current characteristic in the obmotka, and r_1- is the active resistance of the loop.

$$I_2 = \frac{U_1}{\sqrt{\left(r_1 + \frac{r_2'}{s}\right)^2 + (x_1 + x_2')^2}} \quad (1.2)$$

From the above expression, it can be seen that as a result of an increase in motor slip, an increase in the current consumed is observed. In place of the conclusion, mechanical wastes occur at the expense of heat and friction.

Юклама натижасида сарфланаётган токнинг меъёри қуйидагиларни ўз ичига олади:
1) electricity consumption for the technological needs of the Department;
2) electricity consumption for the auxiliary needs of the Department (heating, ventilation, lighting, transport work within the Department, repair plot work, household and sanitary needs of the enterprise);
3) losses of electricity in internal electrical networks, transformers and switches.
Useful energy spent in direct processing, kW·h:

$$W_{п} = k_{з} \cdot \frac{P_{н}}{\eta_{н}} \cdot \text{Т}_{м} \cdot \eta_{ст}(k_{зр}) \cdot \eta(k_{зр}) \quad (1.3)$$

here $k_{з}$ -is the average loading normative coefficient for the power consumed by the head moving stanza engine in the loading mode; $\text{Т}_{м}$ – is the average machine time for processing into one detail, hours.

Function of the useful work factor of the device from the load factor by power in the Motor shaft:

$$\eta_{ст}(k_{зр}) = \frac{5 \cdot \eta_{ст.н}}{5 \cdot \eta_{ст.н} + (\frac{3}{k_{зр}} + 2)(1 - \eta_{ст.н})} \quad (1.4)$$

where $\eta_{ст.н}$ – is the nominal useful work factor of the station, which is determined from the equipment's passport data.

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In approximations, the head movement in rotating equipment is $\eta_{\text{ст.н}}$ =0.7÷0.85, while for equipment in progressive motion it can be taken as 0.6÷0.7.

Useful energy spent in direct processing, kW·h:

$$W_{\text{п}} = k_{\text{з}} \cdot \frac{P_{\text{н}}}{\eta_{\text{н}}} \cdot \text{Т}_{\text{м}} \cdot \eta_{\text{ст}}(k_{\text{зр}}) \cdot \eta(k_{\text{зр}}) \qquad (1.5)$$

$k_{\text{з}}$ -load mode of the movable lathe power consumption of the chimney coefficient level; $\text{Т}_{\text{м}}$ -detail is taken as machine time, hours.

useful work factor function of the lathe from the load coefficient on the power in the engine shaft:

$$\eta_{\text{ст}}(k_{\text{зр}}) = \frac{5 \cdot \eta_{\text{ст.н}}}{5 \cdot \eta_{\text{ст.н}} + (\frac{3}{k_{\text{зр}}} + 2)(1 - \eta_{\text{ст.н}})} \qquad (1.6)$$

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

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 $0{,}6 \div 0{,}7$. At the same time, sufficient energy efficiency and resource efficiency are achieved as a result of ensuring the energy efficient operation of the motors. The main thing is to take the unexpected bothers of the enterprises working without self.

III, CONCLUSION

As a result of the control of the current consumption parameters of electric motors and other energy consumers of the devices being used at the production enterprise, it was found that annual electricity consumption is economy up to 1-3%. At the same time, the resource savings of the enterprise on material resources caused an increase of 15%. It serves to ensure the uninterrupted operation of devices in enterprises that work without interruption. This parameter is of great importance in a market economy.

REFERENCES

1. The Automobile Industry Pocket Guide. European Automobile Manufacturers Association’s report. Belgium, Brussels, 2015. – 78 p.

2. Kachkanian R.A. Ways to reduce friction losses in the crank mechanism of reciprocating internal combustion engines / R.A. Kocharyan, K.S. Kulmagambetov. –Text: direct //A young scientist.-2016.-№10(114). – Pp.231-234

3. Zenis S. E. Ways to reduce mechanical losses in bearings in the design of energy-efficient engines / E. S. Zenis // Bulletin of National Technology. uni-ta "KhPI": collection of scientific tr. Topics. issue: Electric machines and electromechanical energy conversion. – Kharkiv: NTU "KhPI". – 2014. – № 38 (1081). – Pp. 79-89.

4. Ishnazarov O and Koroli M. Combined heat supply "heat pump-solar plant" system *J. Phys.: Conf. Ser.* **1691,** (2020), 012051 doi:10.1088/1742-6596/1691/1/012051

5. U H Hoshimov and O Kh Ishnazarov Group control of air-cooled gas apparatuses // To cite this article: U H Hoshimov and O Kh Ishnazarov 2021 J. Phys.: Conf. Ser. 2094 052051