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SECTION 6. Metallurgy and energy.

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ENERGY AUDIT SYSTEM AT THE JSC «ZAVOD AVTOPRIBOR» (VLADIMIR, RUSSIA)

***Abstract**: The article considers the system of events aimed at the energy audit of the structural units of the JSC «Zavod Avtopribor». The choice of the most rational lighting one of the energy-intensive production premises of the enterprise was performed on the basis of the computer calculation.*

***Key words**: an enterprise, lighting, energy resources.*
***Language**: English*
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Introduction

Energy audit [1] at the enterprises is performed with the aim of the determination of use the energy resources for the subsequent reliability improvement of energy supply.

Vladimir «Zavod «Avtopribor» [2] is currently the largest technology complex, which is specialized on the production of the components for car assembly enterprises of Russia, CIS and other countries. The JSC «Zavod «Avtopribor», with a total area of 140000 m^2, locates on two sites. At the enterprise there are more than 1000 units of the technological equipment, including automated. The equipment placed on the ten industries of the plant. The internal infrastructure consists of the energy supply system, steam supply, water supply, gas supply and water treatment.

The exploitation of the obsolete technological equipment and faults in auxiliary systems can cause irrational use of the energy resources. To eliminate of the energy losses it is necessary regular to conduct energy audits.

Materials and methods

Energy saving at the enterprise is achieved by the following complex of events:

1. Reduction of the losses in all energy types of the production.
2. Decrease of the share of energy costs in the cost structure of the enterprise production.
3. Improving of the competitiveness of the automotive components in the international market.

Methods of the rational use of energy resources at the enterprise are presented in the table 1.

Table 1

Methods of the rational use of the energy resources at the enterprise.

Method name	Method description
«Count, save and pay»	Lean model of the energy resources consumption
«New light»	Gradual replacement of the inefficient light sources to energy-efficient lighting devices
«Small complete energetics»	The implementation of the equipment for the local energetics

Also in the framework of the rational use of the energy resources it was carried out compliance with the current regulatory framework in the field of energy saving, improving of the efficiency of energy use and continuous advanced training of the personnel associated with the organization of energy saving.

By the main components of fuel and energy resources (FER), in percentage terms, are: electrical energy – 50…60 %, steam – 23…30 %, heating –

10…15 %, technical water – 6…8 %, city water – 4…6.5 % and gas – 0.5 %.

The ratio of the approved budget costs of the FER to the actual costs at the JSC «Zavod «Avtopribor» for 5 months of the year is presented in Fig. 1.

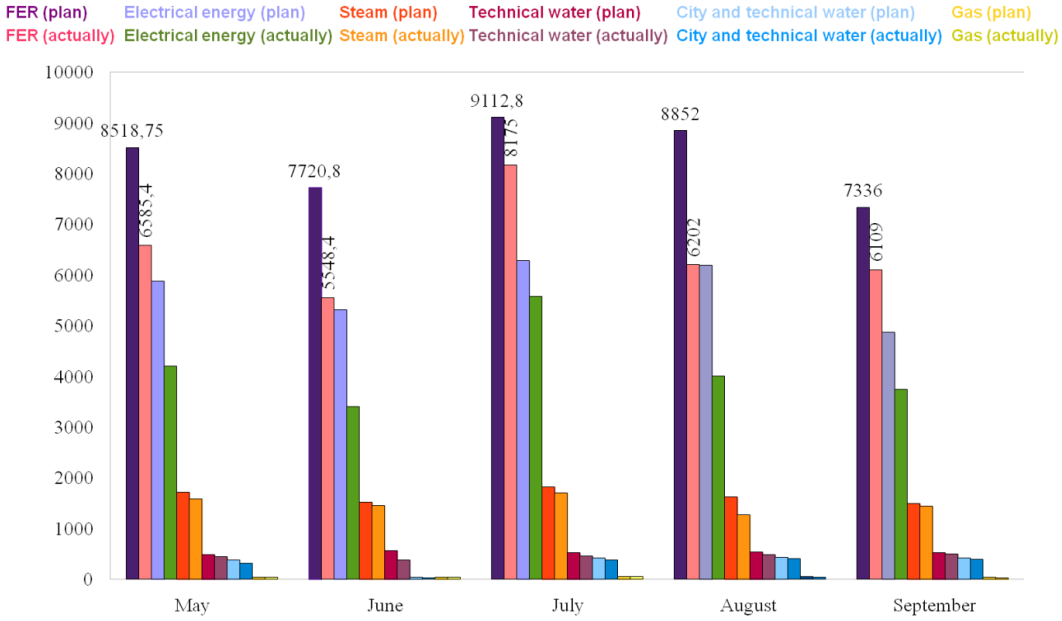


Figure 1 – The ratio of the approved budget costs of the FER to the actual costs.

The procedure of organization and conducting of the energy audit at the enterprise is set by the working instruction of the quality system (WIQS – SGE 17.0-2012) [3]. This manual applies to all structural units, including at the third-party organizations located at the enterprise.

The system of organization and conducting of the energy audit at the enterprise consists of a number of the optimizing actions: the policy of «Energy saving» → planning → arrangement → energy audits → analysis by the management of the enterprise → implementation of the energy saving events → reduction of losses in the energy sector → continuous improvement.

On the basis of developed and approved schedules from May to September, it was made 30 energy audits in the energy-intensive structural units of the enterprise. All information about the violations of the energy use was entered in the summary list. Table 2 presents the revealed violations per working day on the first floor of the industrial building №2, the site «A».

Table 2

The violations of the energy use in the production unit of the enterprise.

Description of violation	Corrective actions	Losses
Working lighting line from 7 to 10 a.m.	To restore the lighting, to provide the instruction	Electrical energy 0.69 kW
7 locations of the steam leaks was revealed on the steam line near the site of the chemical passivation	To prepare the interplant ordering by the elimination of the violations	Steam 7 holes × 24 hours
Around the workshop there were not depressurized the exits of the air ducts through the walls to the outside	To prepare the interplant ordering on the sealing of the passages in the filler structures	Heat losses through the walls are 20 – 30% of the total volume
On the main steam line there was depressurized the valve	To prepare the works on the elimination of the violation	Steam 10 holes × 100.5 hours
The gate with the inscription «Chemical storage» is opened, operators warmed at the expense of the open drying cabinets	To set heat gun	Heat losses through the walls are 20 – 30% of the total volume

The violations were analyzed and implemented the corrective actions. One of the actions it was the reconstruction of lighting in the industrial building №1 on the site «A» by implementing of the energy-efficient lamps. The calculation of the rational illumination of the industrial premise was made by the computer program DIALux [4].

In the program it was set the metric system of calculation of the coordinates and dimensions. The information about the lamps is loaded from the special computer directories. The premise has the following dimensions: length – 102 m, width – 30 m and mounting height – 6.2 m. The workplane, on which was carried out by the calculation, was taken at a height of 0.85 m from the floor level of the premise. The calculation was carried out for the total volume of the premise, which is the boundary zone (the distance from the walls), was taken by zero. The maintenance factor [5] was adopted the value of 0.8. The premise plan was displayed at a scale of 1:730. The reflection coefficient [6] for the floor was set 20 %, for the ceiling – 70 %, for the six walls – 50 %.

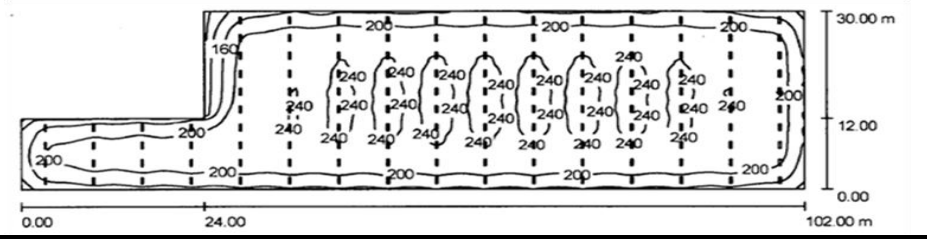
Two options of illuminance of the industrial premise by the lamps were considered:

1. PROTON SSO-220/64-05.XWE. It is led pendant lamp. The lamp has a cosine curve of luminous intensity (CIL) [7] and can be used for the lighting of the office and the industrial facilities with a correction factor of 1.0 [8]. It is necessary 136 pieces with a power of 72 W and the intensity of the light flux of 6720 lumens.

2. Energy saving lamp TSU LSP-01-2×58-S with a correction factor of 1.0. It is necessary 84 pieces with a power of 110 W and the intensity of the light flux of 10400 lumens.

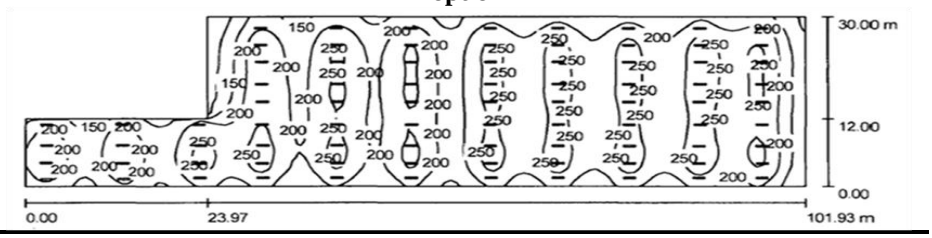
The results of the calculations are presented in Fig. 2.

1 option



Parameter	Workplane	Floors	Ceiling	Walls
$E_{avg.}$ (lx)	214	210	45	102
$E_{min.}$ (lx)	70	84	30	40
$E_{max.}$ (lx)	246	242	58	244
$E_{min.}$ / $E_{avg.}$	0.325	0.402	0.679	
Φ (lm), total		913920		
P (W), total		9792		

2 option



Parameter	Workplane	Floors	Ceiling	Walls
$E_{avg.}$ (lx)	214	209	47	132
$E_{min.}$ (lx)	63	76	31	37
$E_{max.}$ (lx)	283	263	125	735
$E_{min.}$ / $E_{avg.}$	0.29	0.36	0.65	
Φ (lm), total		873600		
P (W), total		9240		

Figure 2 – The results of the lighting calculations of the production premise.

In the figure indicated:
$E_{avg.}$ – average illuminance;
$E_{min.}$ – minimum illuminance;
$E_{max.}$ – maximum illuminance;
$E_{min.}$ / $E_{avg.}$ – uniformity of the illuminance distribution;
Φ – intensity of the luminous flux;
P – power.

Specific connected load for the first option is 3.73 W/m^2, for the second option is 3.52 W/m^2. Ground area – 2628 m^2.

By the lower expended total power and the highest maximum illuminance the second option of the calculation is preferred.

Conclusion

The optimization of the energy consumption of the enterprise is realized by the with complex calculation and the further analysis of the energy-intensive productions in the structural units. Monitoring of use the FER during the prescribed plan shows an effective implementation of the audit system in the enterprise.

References:

1. (2017) Energy audit. Available: https://en.wikipedia.org/wiki/Energy_audit (Accessed: 02.04.2017).
2. (2017) Avtopribor. Available: http://avtopribor.ru (Accessed: 02.04.2017).
3. (2017) Uninterruptible power systems. Available: http://www.remostroy.com/default.aspx?did=12 (Accessed: 02.04.2017).
4. (2017) DIAL light building software. Available: https://www.dial.de/en/home/ (Accessed: 02.04.2017).
5. (2017) Maintenance factors. Available: http://en.wiki.dialux.com/index.php/Maintenance_factors (Accessed: 02.04.2017).
6. (2017) Reflection coefficient. Available: http://remartspb.ru/infopages/kojefficient_otrazhenija.php (Accessed: 02.04.2017).
7. (2017) Light intensity curve. Available: http://www.astarta-led.ru/kss/ (Accessed: 02.04.2017).
8. (2017) Correction factor. Available: http://elektrika-svoimi-rykami.com/raschet-osveshheniya/raschet-osveshheniya (Accessed: 02.04.2017).