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Improved Planning, Operational Control and Reporting for Energy Use in Mining Enterprises of Uzbekistan

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ABSTRACT: Studied analyses of the planning on energy use at mining processes. It was developed a model for quarry analyzing data on electricity consumption and production value. The planning of energy use, taking into account the impact of energy consumption in production volume of the rock mass leads to increase of planning and reporting of power consumption, which it will provide a more adequate analysis of energy.

KEY WORDS: energy use, energy saving, mining process, operational control and reporting.

I. INTRODUCTION

It is necessary to establish the relationship between technology and power modes of production processes for increase the level of analysis and planning in energy use.
In many cases, the optimal modes of energy consumption are corresponding to the maximum capacity of the process tool with a minimal energy consumption. Therefore, the intensification of production processes and improving their organization always cause energy saving. In this sense, the specific energy consumption is a general indicator of technical and economic level of production in general.

II. SYSTEM ANALYSIS

To improving energy efficiency is an important element in the changing conditions in mining process. For investigation and planning of energy consumption and also to develop methods for rationing of electricity consumption necessary to establish the energy intensity of production processes of the main energy-consuming tool.
Excavators and drilling machines are main electricity consumers in the open pit mining. To establish and use of energy characteristics is a difficult task due to the large number of machines having different design features and operating modes. Therefore, for the analysis and planning of electricity consumption in the ore it is advisable to determine patterns of energy consumption as a whole by quarries and mines. For practical use of energy necessary to consider the energy consumption and index of production process, such as the volume of the rock mass. [1]

III. METHODOLOGY

Consumptionto electricity in the open pit mining consists of two components: constant that is not depending on the value of product and variable – in the first approximation, directly proportional to the product. Therefore, when analyzing and rationing of electricity are important energy characteristics that express the dependence of the power consumption to the value of products. In order to improve the planning carried out investigation for electricity consumption in open pit mining of Navoi mining area. Analysis of the specific consumption of electricity was carried out on using of correlation analysis methods. Results of the analysis should be used to quantify the impact of industrial and technological factors on the change in the specific consumption of electricity. The reliability of mathematical models of energy consumption was estimated compliance rate, which represents the ratio of the actual specific energy consumption in the reporting year to the specific energy consumption, calculated on the resulting model of electricity.

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When planning for the future electricity consumption should take into account the change in specific energy consumption for the activities for energy saving. [2]

It was developed a model for "Muruntau" quarry analyzing data on electricity consumption and production value:

$$\omega = 0{,}87 - 3{,}73 \times 10^{-6} Q \qquad (1)$$

Where:

ω - the specific power consumption, kWt·h/m^3;

Q - the volume of the rock mass, thousand m^3.

At present time the planning of electricity use is conducted by approval norm of specific energy use that is not taking into changing of produced volume in case compare the reporting period with planned.

The approved norm for the development of mined rock mass of quarry "Muruntau" is given in Figure 1 the line 1 - $\omega = 0{,}78 кВт * ч / м^3$ - "point" planning.

To plan the rate of electricity use depending on the production volume in accordance with the power characteristics is a more advisable which shown in Figure 1, the line 2 - $\omega = 0{,}87 - 3{,}73 \times 10^{-6} Q$ - "regional" planning.

Execution of the production program for the period the production volumes have some variation, and may not always coincide with the plan, and therefore should be adjusted normative specific energy consumption.

In this example, in the planned production volume of the rock mass existing planned rate of specific energy consumption (point B). [2]

In the issue implementation of the production program extracted rock mass up to 27000 m^3 (point E). In this case, the specific regulatory planned power consumption should be adjusted (point D $\omega = 0{,}775 кВт * ч / м^3$). The factual power consumption can be made values to the points F_1, F_2, F_3.

IV. RESULTS

In case actual specific power consumption F_1, then energy consumption plan is not performed. In case actual specific power consumption F_2, then noticed energy saving against planned by the "point" estimate (point F). However, taking into account existing regularity diminution of the specific power consumption at increasing production volumes normable specific power consumption should be corrected (point D) and thus actually occurs overruns of electricity. Only in case the power consumption on point F_3, there is significant energy savings.

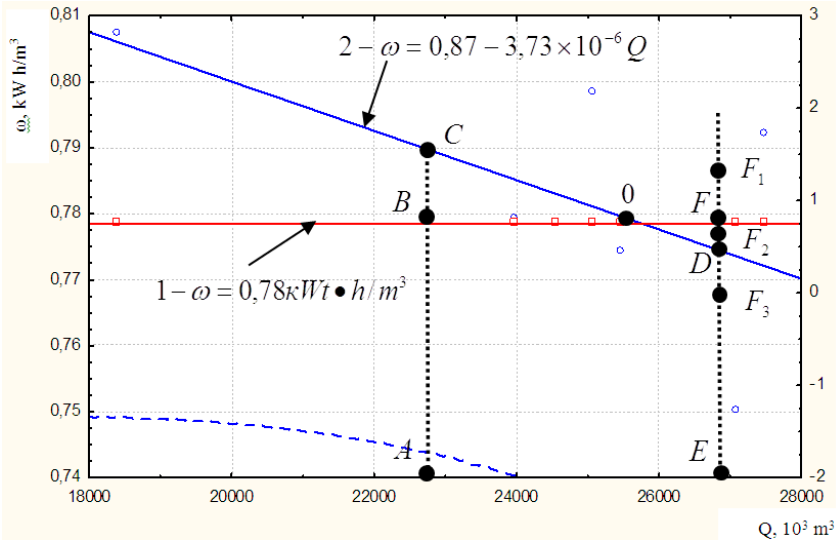

Figure 1. Diagram of planning and reporting for the power consumption by a "point" (line 1) and "regional" (line 2) estimates

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A similar reasoning and related assessments may be conducted if the actual production volume for the reporting period is less than planned. In this case, for a reliable analysis of the planned rate of power consumption should be corrected for side in compared with the planned for the "point" planning. [3]

In this way, the planning of energy consumption, considering the impact of energy consumption in production volume of the rock mass leads to increased planning accuracy and reporting of power consumption, which in turn, will provide a more adequate analysis of energy consumption and measures to improve energy efficiency.

Operational management of power consumption and their improving should be provided by administrative actions, formed on estimates of actual power consumption deviations and planned using the power characteristics.

Indicated deviations will be formed in the technological and temporal scale:

• Quarry, based on actual monthly expenses of power consumption and scheduled monthly expenses, set by the energy characteristics of a quarry.

The above management actions will improve the level of operational energy management both - in temporary (month) and in organizational-technical levels.

Increased reporting of power consumption should allow: to improve the accuracy, timeliness and reliability of the reports; to increase staff motivation through more adequate assessment by the management, their efforts in the field of energy efficiency.

Accuracy, timeliness and accuracy of the report is enhanced by:

• high level of planning based on developed energy characteristics and recommendations;

• adapting to changes in production volumes (structuring in organizational, technological and temporal scales);

• improved operational management of power consumpsion (systematic formation and evaluation of deviations in actual and planned specific consumption of electricity).

Implementation of proposed recommendations provides to improve conditions for a more adequate assessment by the management staff efforts towards the efficient use of electricity.

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