Critical evaluation of energy use in industrial enterprises

Bobojonov *Y.M.*[1,*], Saidkhodjaev *A.G.*[2]

[1]Karakalpak State University, Nukus, 230101, Uzbekistan

[2]Tashkent State Technical University named by Islam Karimov, Tashkent, 100095, Uzbekistan

Abstract. The paper analyzes the use of energy resources in industrial enterprises. Based on the results of the work carried out, the main points of the irrational use of energy resources are given. An analysis of the state of accounting and control over the consumption of energy resources and an overview of the current situation with energy saving at industrial enterprises is given.

1 Introduction

The presented review of literary sources shows that at present the problems of energy saving in industry are solved with varying degrees of completeness, with a predominance of simplified methods. These methods are based mainly on the quantitative indicators of industrial enterprises in the production of final products, without studying the underlying processes of industrial production. As a result, in some cases, only those reserves of energy savings that are on the surface and reserves from the implementation of measures that do not require experimental and methodological guidelines can be identified. Deeper, comprehensive studies of the processes of power consumption are still carried out at a very limited number of enterprises. Naturally, such a situation does not always make it possible to present the true value of energy indicators [1-6, 11, 12].

In addition to the above, it should be noted that the system of analysis and control of energy indicators adopted at the present time is rather primitive. So, for example, in many industries, analysis and control of energy indicators is carried out periodically, by means of special measurements for various periods of time. Naturally, such measurements cannot reflect the entire dynamics of changes in the calculated parameters and do not make it possible to identify the pattern of their changes.

Our studies at a number of industrial enterprises in various industries have shown that with the existing organization of accounting for the consumption of energy carriers and energy resources, it is impossible to assess the real efficiency of their use and reasonably normalize the consumption of energy resources [7-10, 13].

An analysis of the state of accounting and control over the consumption of energy resources at industrial enterprises showed that, with rare exceptions, this issue remains practically insufficiently resolved. So, for example, the unsatisfactory situation that characterizes the majority of enterprises takes place with the instrumentation of the entire energy supply system. As a rule, all enterprises have commercial electricity metering; as for the metering of other types of energy, in many cases it is absent.

Accounting for energy resources in certain industries, production units, energy-intensive units and processes, also does not exist at all enterprises. In addition, as a rule, there is no accounting for individual components of the technological process, such as compressed air, nitrogen, hydrogen, water, etc. This leads to the loss of opportunities for the correct distribution, accounting and control of energy consumption.

A big disadvantage is the weak introduction in industry of automated systems for accounting and control of energy resources, which are installed at single industrial facilities and are used very inefficiently. As a rule, these systems take into account and control only the following parameters: power consumption, energy consumption and indicators of other energy carriers, and thus are used mainly as informational ones.

However, these functions are clearly insufficient for energy saving management, since the obtained information on the consumption of all types of energy resources cannot be used to solve the main energy saving tasks necessary for optimal energy consumption management [15-19, 14].

* Corresponding author: kamal_tstu@mail.ru

2 The current state of the investigated problem

The above review of the current situation with energy saving in industry shows that this problem is in most cases solved without in-depth research and is devoted to solving particular problems of rationalizing energy use processes. In addition, the solutions obtained for individual private tasks cannot be copied for other enterprises, since each of them has its own specifics in terms of the mode of operation (single-shift, two-shift, round-the-clock), products (homogeneous, heterogeneous, multi-assortment, etc.) etc.

At the same time, it should be noted that when developing priority measures, one should not be limited to identifying and eliminating the causes that lie on the surface (overstating the power of equipment, the presence of idle operation of this equipment, an irrational mode of electric lighting, insufficient thermal insulation of equipment, etc.).

The energy intensity of industrial products, as the main indicator of the energy saving process, is a function of many variables associated with electrical, mechanical, thermal, organizational, physical and chemical, as well as other production factors that affect this indicator. Based on this, in order to manage the energy saving process, it is necessary to develop an adaptive control system that is self-adjusting to any changes, both internal and external factors, which allows minimizing the energy component in the cost of products.

The norms existing at the enterprises of the cotton and silk industry, obtained by experimental statistical methods, not only do not stimulate the rationalization of electricity consumption, but do not even stimulate the correct organization of accounting and control over the consumption of electricity. The development of reasonable standards can be carried out only if the entire set of data necessary for this has been identified. In addition to the correct organization of electricity metering, a detailed analysis of electrical loads and electricity consumption by units, workshops and the enterprise as a whole, factors affecting the specific electricity consumption should be identified, energy characteristics should be built, experimental data should be mathematically processed, etc. This work, as V. I. Lapitsky correctly points out, should be carried out on the basis of a systematic approach with the solution of problems of optimizing the energy economy and rational use of electricity.

Naturally, the implementation of such, in some cases, a significant amount of research, requires certain financial outlays on the part of the enterprise to pay for the work of a research or other specialized organization, or even when these works are performed by the energy services of the enterprises themselves. Despite the fact that electricity rationing is a prerequisite for the correct organization of production, that this is a necessary prerequisite for the implementation of all measures to save energy, proper planning and forecasting, such a general assessment of the need for rationing is still insufficient. An operating self-supporting enterprise requires a specific assessment of the economic efficiency of each such work. This assessment should be based on the fact that the process of establishing scientifically based norms is associated, as mentioned above, with the optimization of power consumption modes, i.e. identifying the main, potentially possible measures to reduce losses and unproductive costs of electricity.

3 Definition of critical elements in energy systems

Considering that the studies related to the development of standards require many years for their implementation, all costs associated with the regulation should be brought to the year preceding the beginning of the estimated year of implementation.

The issue of the efficiency of instrument installation, energy metering and the development of standards should be addressed comprehensively, as a single event.

However, speaking about the organization of accounting for all types of energy, it follows, in our opinion, to single out electrical energy from the general problem.

The fact is that the authors of proposals for evaluating the effectiveness of instrument metering are based mainly on examples of installing meters for steam, water, air, gas, etc. These rather expensive devices require significant additional installation and installation costs, especially in those cases where they were not provided for by the project. Therefore, proposals on the economic justification of these works are legitimate.

The situation is different for electricity. Estimated electricity metering is installed at the inputs of all, without exception, industrial enterprises, and thus, we can only talk about justifying the installation of technical (control) metering. This accounting, with rare exceptions, is already available in all shops and energy-intensive units. In addition, at all substations for protection purposes and measurements, there are measuring current and voltage transformers, which means that if there is no technical metering of electricity anywhere, then there are all conditions for installing a meter, and the costs for these purposes are reduced to purchasing a meter [20-24, 8].

The effect from the introduction of measures to save electricity, identified in the process of research and development of standards, was adopted by us as a criterion for the expediency of developing the whole range of issues of regulation, and not just electricity metering.

Very often, energy savings can be obtained as a result of purely technological measures (improvement of technology, installation of more productive machines, etc.). In this case, the electricity component of the total savings should be taken into account.

4 Conclusion

It should also be noted that the proposal to compensate for the costs of rationing by savings from a decrease in specific electricity costs cannot always be used, because. a correctly set rate may be higher than the actual rate due to the introduction of energy-intensive technology. In addition, the specific power consumption may be close in value to the limit of the potential value. Then there will either be no savings, or its magnitude will be very insignificant.

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