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ANALYSIS OF EFFICIENT MANAGEMENT METHODOLOGY OF FUEL-ENERGY COMPLEX ENTERPRISES

M. B. Sultanov
Department of "Information Systems and Technologies",
Tashkent State University of Economics,
murodkhan.sultanov.1987@gmail.com

Abstract
The article presents a systematic analysis of the problems of effective management of fuel and energy resource flows. The analysis of literature on energy management processes is described. The main problems of the operation of energy management processes in the enterprises of the fuel and energy complex are considered and a functional model of their solution is presented. The work shows the essence of energy management and each of its processes.

Keywords: Systematic analysis, management, energy management, functional model, information and communication technologies, decision-making.

Introduction

Today, solving the issues of managing the consumption of fuel and energy resources and increasing the efficiency of using fuel and energy resources is one of the priority tasks of the development of enterprises operating in the oil and gas production sector. One of the most important aspects of the successful operation of production enterprises is a systematic approach to production management.

Currently, E. Pinero, G. Lambert, T. Frank, T. H. Gulbrandsen, N. Neill, R. N. Anderson, S. Hensen, D. Weissman, A. Breeden and other foreign scientists are actively conducting research in the field of energy management. Their scientific work is aimed at studying the theoretical foundations of the effective functioning of energy management in production management systems that meet modern requirements. In addition, the scientific research works of Russian scientists such as K.N. Savin, V.V. Kharchenko, A.V. Tikhomirov, V.A. Begalov, N.V. Zaitsev, Y.Yu. Kudryavtseva, T.Yu. Anisimova, S.P. Kovalya and D.G. Trofimov are devoted to the theoretical aspects of energy management. Issues such as management of fuel and energy resource consumption in production enterprises, saving and increasing energy efficiency, as well as its development, are discussed by D.B. Ponarovkin, A.G. Bebeshev, I.O. Volkova, M.S. Berner, V.I. Kolibaby, A.V. Loskutov, A.N. Tarasov, S. Buchin, M.M.

Brodach, A.V. Zverev, A.P. Haustov, N.S. Yablonsky and M.M. It was studied in the scientific works of scientists such as Redina.

Problems of interpretation of international standard requirements in the field of energy management, creation of necessary conditions for their adaptation and implementation in production practice S.A. Khokhlyavin [4], Yu.Yu. Kudryavtsev, Ya.M. shchelokov, S.V. Khorobrykh, A.A. Vorobev, D.V. Sklyarov, G.N. Marchenko, I.G. Akhmetova, V.M. Makarov, M.D. Marchenko, R.R. Farhutdinov, A.A. Osadchiev, E.V. Fadeeva, I. L. Pichugin, V.A. Lukinov, V.A. Syshchikov, V. G. Tarasovsky, A.I. Syusyukin, G.I. Eremeeva, N.F. Shishkina, A.F. Considered in the work of scientists such as Kuznetsov.

I.A. Bashmakov, A.V. Babkin, M.P. Melnikova, A.A. Makarov, V.E. Fortov, I.K. In their scientific works, Khuzmiev and others revealed problems such as increasing the level of management and saving of fuel and energy resources consumption, as well as ensuring energy efficiency within the framework of the development and implementation of national and regional state programs [6].

As a result of a systematic analysis of the literature, it is proposed to consider energy management in the general management system of an enterprise in order to effectively manage the consumption of fuel and energy resources as a targeted activity that is directly related to solving a set of interrelated issues in the process of planning, organizing, motivating and controlling, aimed at reducing the consumption of fuel and energy resources, along with the use of modern methods of effective management of fuel and energy resources. In addition, it should be noted that the concepts of "Energy Management" and "Energy Management System" are considered two different concepts, and in many cases they are replaced and considered the same. Even the main ISO 50001:2011 standard "Energy Management System. Requirements and Guidelines for Application" does not provide the concept of energy management, but only a definition of an energy management system.

Modern literature presents different approaches to the concept of energy management. These approaches can be divided into two types: conceptual and structural approaches.

The following Russian scientists expressed their understanding of the conceptual approach to the concept of energy management:

Savinov K.N.: Energy management is a management project that includes the creation of a suitable management structure with mechanisms that control the rational use of fuel and energy resources, which allows for the sequential and precise execution of planning, the provision of ways and conditions to reduce the consumption of fuel and

energy resources in order to increase the competitiveness of the products produced in the enterprise [3].

Khokhlyavin S.A.: Energy management is a management system that involves the involvement of mature and qualified specialists in the management system of an enterprise, constantly monitoring the consumption of fuel and energy resources and informing management with information on fuel and energy resource consumption indicators [4].

Kharchenko V.V. and Tikhomirov A.V.: Energy management is a management system based on audit, continuous measurements and inspections to control the consumption of fuel and energy resources. In this case, the enterprise will be able to provide fuel and energy resources necessary for production on time [5].

V. A. Begalov: Energy management is a set of management methods for increasing the efficiency of saving fuel and energy resources, unlike engineering, technical, technological, etc. It is a key element of quality management policy [6].

Zaitsev N.V.: Energy management is a management system that includes organizational and managerial measures that must be implemented in an enterprise in order to increase the efficiency of saving fuel and energy resources. In this case, based on research conducted by experienced and qualified specialists on energy saving, various measures are developed and implemented by the management in the activities of the enterprise [7].

The following Russian scientists expressed their understanding of the structural approach to the concept of energy management:

Koval S.: Energy management is a system that manages only consumed fuel and energy resources necessary for production, based on standard measurements and checks [8].

Khokhlyavin S.A.: Energy management is a set of interconnected and interacting elements that are based on energy policy, goals, processes and procedures and allow achieving these goals [9].

Trofimov D.G. and Podvigov F.A.: Energy management is a complex tool that allows enterprises of any type and size, regardless of geographical and social conditions, to develop a system and process necessary to increase the efficiency of saving fuel and energy resources, including improving the efficiency of fuel and energy resources, their efficient use and consumption [10].

In recent years, a lot of work has been done and scientific publications have been published in the world to determine the essence of energy management and introduce its stages to large manufacturing enterprises. For example, O'Callaghan and Probert in their scientific publications interpreted the essence of energy management as

follows: Energy management is the management of the consumption, production and supply of fuel and energy resources. It is a system that includes issues of monitoring, measuring, recording, analyzing, controlling and redirecting the flow of fuel and energy resources [11]. Abdelaziz in his research work defined energy management as a strategy for meeting the need for fuel and energy resources regardless of when and where they are [12]. Bunse in his monograph stated that energy management in production is a management process that includes measures to control, monitor and improve the consumption of fuel and energy resources [13]. Ates and Durakbasa, in their research, defined energy management as a means of controlling the consumption of fuel and energy resources, which allows reducing the emission of harmful waste into the environment [14].

As a result of systematic analysis, it became clear that in the scientific research conducted by world and domestic scientists on the theoretical and methodological aspects of energy management, energy management models and algorithms have not been sufficiently developed and presented. In scientific and practical studies, the problems of forming effective mechanisms for implementing the concept of the energy management process, taking into account existing international experience and the requirements of international and national standards developed in this area, have not been well developed.

The following shortcomings were identified in the large-scale research work conducted by scientists on energy management: - models of each process of energy management have not been sufficiently studied; - issues of informational interconnection between energy management processes have not been considered; - general recommendations on planning the consumption and expenditure of fuel and energy resources in the energy management planning process to achieve energy goals have not been provided; - issues of assessing the quality of data in information systems for recording real data on the consumption of fuel and energy resources have not been sufficiently studied; - information on decision-making support systems that allow for effective and rapid decision-making in the energy management decision-making process has not been provided.

The Main Part

Based on a systematic analysis of scientific research conducted in the field of energy management, energy management can be defined as follows: Energy management is a constantly moving system that effectively manages the consumption of fuel and energy resources, significantly reduces their consumption, and plans and controls the

process of supplying and using fuel and energy resources necessary for the production activities of an enterprise.

The main tasks of energy management are: - optimization of existing production and technological processes; - increasing the energy efficiency of production systems; - application of new technologies and equipment; - use of energy efficiency criteria in the design and implementation of new facilities; - introduction of modern systems for technological accounting of energy and technical indicators; - use of advanced methods and approaches in the enterprise management system.

The energy management methodology is based on the continuous improvement cycle, founded by the famous scientists Deming and Shewhart, and this methodology is often referred to in the literature as the Deming-Shewhart cycle. This continuous improvement cycle includes the processes "Plan - Do - Check - Act". Figure 1 below shows a functional model of the continuous improvement cycle.

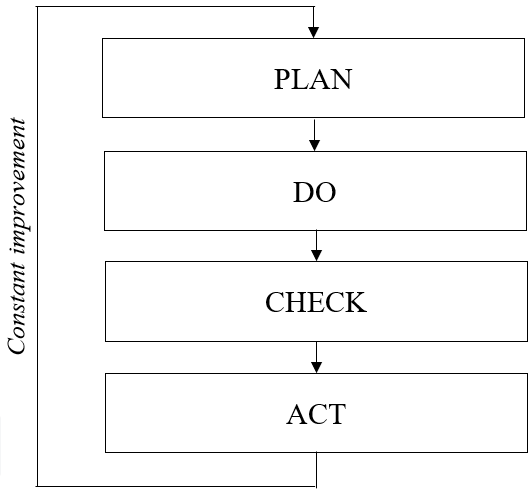

Figure 1. Diagram of the functional model of the continuous improvement cycle

Continuous improvement is a repetitive process that ensures that processes are in an optimal state to achieve set goals. The goal of the continuous improvement cycle is to bring the enterprise's activities to the highest level, while maintaining the efficiency, effectiveness, and productivity of the enterprise's operations. This, in turn, allows the needs of interested parties to be constantly met.

Based on the functional model of the continuous improvement cycle and its methodology, we can express the processes of energy management using the following sequence:

EM = (PPE, PAP, PMA, PDM)

here PPE - the process of planning the consumption of fuel and energy resources; PAP - the process of implementing the planning process in the activity of the enterprise; PMA - the process of monitoring and analyzing the consumption of fuel and energy resources according to the plan; PDM - a decision-making process by a decision-maker to improve performance.

Let's consider the processes of energy management listed above separately:

The process of planning the consumption of fuel and energy resources involves conducting an energy audit, analyzing the data obtained, calculating the initial indicators of fuel and energy resources consumed by the enterprise, identifying facilities that significantly consume fuel and energy resources, clearly defining goals and objectives in the field of saving fuel and energy resources and increasing energy efficiency, and developing measures and programs necessary to improve energy performance in accordance with the enterprise's energy policy.

In the process of applying the plans to the enterprise's activity, the methods of solving all the issues mentioned in the planning process are applied to the enterprise's activity.

In the process of monitoring and analyzing the planned consumption of fuel and energy resources, tasks such as obtaining data on the consumption of fuel and energy resources from consuming facilities using measuring instruments, verifying the implementation of goals and objectives in the field of energy saving and increasing energy efficiency in accordance with the enterprise's energy policy, identifying and documenting unfulfilled requirements, and preparing reports on the results obtained as a result of the inspections carried out are performed.

In order to improve work performance, analyzing the results of the measures taken by the decision-maker in the decision-making process to save fuel and energy resources and increase energy efficiency, determine the reasons for indicators that do not correspond to the plan, and implement the plan refers to issues such as eliminating causes without changing them.

After all the processes are completed, all processes are reviewed in order to increase the energy efficiency of the enterprise and improve the processes of energy management. The revision is repeated until an acceptable figure is reached.

In the literature on optimization issues, the mathematical model of the problem of optimal planning of production in enterprises with a complex production process is presented in the following form:

$$F = \sum_{j=1}^{n} c_j x_j - \sum_{j=n+1}^{n} d_j x_j \to \max$$

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$$\underline{b_i} \le \sum_{j=1}^{n} a_{ij} x_j + \sum_{j=n+1}^{p} a_{ij} x_j \le \overline{b_i},\ i = 1,\ldots,k,\ x_j \ge 0,\ j = 1,\ldots,p$$

where c_j is the selling price of the product x_j, $j = 1,\ldots,n$ is the sales variables; d_i is the cost price of the product x_j, $j = n+1,\ldots,n$ is the purchase variables; $j = n+1,\ldots,p$ is the internal factor variables (equipment load, raw material quality, etc.); a_{ij} is the constant coefficients of the matrix constraints; $a_{ij}(x_j)$ is the coefficients of the matrix constraints depending on the selling price of the product x_j, $\underline{b_i}, \overline{b_i}$ is the right and left parts of the constraints, $i = 1,\ldots,k$. The criterion for solving this problem is the highest profit F [15, 16].

In the implementation of functional issues of energy management, the development and implementation of issues aimed at achieving planned indicators is carried out with the help of decision-making processes.

The decision-making problem is one of the most important issues affecting the strategic development of an enterprise and the quality of its products. We will consider the search for a decision-making problem in the field of situations. In general, the decision-making problem is expressed as follows, that is, a certain initial and final state or a set of similar states, as well as rules for changing the set of states, are given. It is required to find a sequence of transformation rules that will allow changing the initial state to the final state, satisfying the specified requirements. If the sought sequence meets the desired requirements, then we have the problem of finding an optimal solution. If the sought sequence meets the feasible requirements, then we have the problem of finding a feasible solution.

The development of information and communication technologies allows the creation and use of various software tools for solving decision-making problems. This, in turn, allows the decision-maker to make effective and quick decisions. Today, there are many decision-making support systems that allow for automatic decision-making.

Decision support systems consist of two main components: data storage and analysis tools. Data storage can be represented by models of the subject area, which contain various documents and knowledge bases. Analysis tools are designed to help make decisions based on this data. Decision support systems, in turn, are divided into operational and strategic types. Operational decision support systems are designed to immediately affect the current situation, while strategic decision support systems are based on analyzing information from various sources, involving data from systems that collect solutions to problems accumulated over many years of experience.

Currently, data analysis in decision-making support systems uses methods called Intelligent Analysis Data, such as Data Mining and OLAP (On-line Analytical Processing).

If a decision is made using models and algorithms of intelligent data analysis in the decision-making process, the decision will be qualitative and effective. All methods used in intelligent data analysis today are a logical set of various analytical approaches that have been known for decades. The reason why these methods of intelligent data analysis are widely used in management systems in many industries today is due to the fact that they can collect a large amount of data and perform actions on them faster.

Conclusion

The conducted studies have shown that the problem of choosing the right model and method for effective management of enterprises has always been. As a result of the rapid development of information and communication technologies, with the emergence of methods for intelligent data analysis, decision-makers and specialists have been able to analyze data in a convenient, expressive and understandable interface using a computer. This, in turn, has made the problem of choosing the right model and method less relevant for the decision-maker. Taking into account the above, it can be concluded that when performing operations on the same data using different methods of intellectual data analysis, different results can be obtained. Such results, in turn, can cause irreparable errors in enterprises with complex production processes. Therefore, one of the main tasks of manufacturing enterprises is to identify methods that allow making correct and quick decisions.

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