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РАЗРАБОТКА МЕТОДИКИ ОЦЕНКИ УРОВНЯ ЭКОНОМИЧЕСКОЙ БЕЗОПАСНОСТИ ГАЗОТРАНСПОРТНОГО ПРЕДПРИЯТИЯ С ПОМОЩЬЮ ТАКСОНОМЕТРИЧЕСКОГО МЕТОДА

Проведено исследование теоретико-методологических основ оценки экономической безопасности газотранспортных предприятий. Получен интегральный показатель уровня экономической безопасности газотранспортного предприятия, который обеспечивает возможность получения как можно более точных данных о состоянии экономической безопасности, а также о индексе значимости составляющих деятельности газотранспортного предприятия. Предложенная в работе методика позволяет разработать эффективную модель управления предприятием, которая обеспечивает стабильное развитие и избежание неблагоприятных факторов или угроз.

Ключевые слова: метод вариаций, экономическая безопасность газотранспортных предприятий, уровни развития, алгоритм оценки.

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FORMATION OF SYSTEM FRAMEWORKS OF ENERGY CONTROLLING

Проаналізовано можливості застосування концепції контролінгу в енергетичній сфері підприємства та розглянуті науково-практичні положення її нового напрямку – енергетичного контролінгу, як мультіфункціональної системи, що управляє кількісними параметрами енергоефективності. На засадах системного аналізу було побудовано системний контур енергетичного контролінгу, який окреслює міжфункціональні зв'язки та сфери його взаємодії з управлінськими системами підприємства.

Ключові слова: *енергетичний контролінг, енергетичний менеджмент, енергетична ефективність, системний контур.*

1. Introduction

Energy efficiency as far as energy saving and energy security are modern challenges not only in Ukraine, but also in most countries that do not possess significant natural hydrocarbon reserves. But in Ukraine this challenge is close to be a big problem because of energy-intensive industrial production and a low level of energy saving among the population.

Therefore, the scientific and practical interest in the field of effective energy resources management is becoming more and more extensive. However, Ukrainian economists as a rule associate the energy management mostly with organizational and technical support of energy equipment use.

Nevertheless all over the world as commercial companies, so regional and national decision makers look for new approaches to enhance energy efficiency, guarantee energy security and improve other energy related issues. This practical need led to one more direction in development of controlling concept called energy controlling. Using the base controlling principals – transparency, reliability, optimality, and consistency – energy controlling is called to build up the system for efficient management of energy resources. That's why it's timely to research system frameworks of energy controlling.

2. The object of research and its technological audit

The object of research is the controlling concept and its application in the energy sector of the enterprise.

To conduct an objective study of economic levers for increasing the energy efficiency in industrial enterprises, world ratings of energy-efficient economies were analyzed. According to surveys made by the non-profit organization the American Council for an Energy-Efficient Economy (ACEEE), Germany firmly holds the leading position on energy efficiency among the world's largest energy-consuming economies during last years [1]. Therefore, German business models in this area deserve special attention.

The German researchers consider energy controlling to be the most promising direction for improving the energy efficiency, energy saving and energy security of an industrial enterprise [2–6]. Basing on the conceptual and instrumental basis of controlling and realizing its functions in the energy sector, energy controlling transforms the traditional understanding of the «controlling system». As a result, there are specific technical and economic approaches to solve management problems, expand the tools of controlling.

One of the most challenging areas in modern Ukraine is insufficient levels of transparency, reliability, optimality,

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and consistency in economic relations. The study on the formation of system frameworks of energy controlling will help to build a system that corresponds these challenges and ensures efficient management of energy resources in organizations.

3. The aim and objectives of research

The aim of research is to study the conceptual matter of energy controlling, as a multifunctional system for achieving required levels of energy efficiency, energy saving and other energy objectives. To achieve this aim, it is necessary to perform the following tasks:

1. To describe the operational cycle of energy controlling.
2. To outline energy controlling in the system frameworks with interfunctional coordination of managerial activity that is characteristic of controlling.

4. Research of existing solutions of the problem

Studies on energy efficiency are often interdisciplinary. Their authors combine economic and technical sciences [2–4]. However, core scientists [2] come to the conclusion that with the current level of development of technology the enhancement of energy efficiency is mostly related to its management.

Theoretical research and practice practical experience proves priority of energy management, if the organization seeks to reduce energy costs in general production costs, to comply with the constantly growing regulatory requirements in Europe for environmental friendliness and energy efficiency, and to improve its image and corporate culture [2, 7–9]. Because of the severity of energy issues, the Ukrainian author even calls «energy management – the basis of the effectiveness of the Ukrainian economy» [8].

Most of the analyzed publications on energy management related either to the substantiation of the role and place of energy management at micro- and macrolevels [7, 8], the description of its implementation stages [8, 9], or its functional content and instrumentation [9]. However, after the adoption of the international standard ISO 50001:2011, «Energy management systems – requirements with guidance for use», the discussion on energy management issues should move from theory into practice. Indeed, the latest publications in this area concern the practical application of the standard ISO 50001:2011 [2].

The analysis of the ISO 50001: 2011 shows that it does not provide answers to questions about the required level of energy efficiency, energy saving, energy security, etc. This standard outlines the sequence of actions according to which the organization must find its own solutions, adhere to them and thus improve the day after day the awareness and attitude of their employees on energy issues, as well as the quantitative indicators of energy usage. Therefore, controlling concept together with its functional and instrumental content can be of significant support for management decisions regarding the use of energy resources in the organization.

There are not so many publications in energy controlling. Research of one Ukrainian economist concerned mainly the search for interaction points between energy management and energy controlling. As a result, she came to the conclusion that energy controlling is part of energy management [10]. Among other authors there is no unequivocal opinion on this issue. In their earlier publications, some of them [5] also tended to the same point of view [10]. However, the authors of later publications [2, 6, 11, 12] disagree with them – they consider energy controlling to be an independent phenomenon that has emerged and is developing as response to modern technical, technological and socio-economic challenges. At the same time, some of them see energy controlling in the form of a software product that would combine the functions of controlling and the energy consumption of the enterprise [6]. Others, without abandoning the information component of energy controlling, insist on a broader understanding – in a form of an integrated system for information and analytical support of management decisions in the energy sector of the organization [2, 12].

Nevertheless, all mentioned authors agree that energy controlling is able essentially to increase energy efficiency because of internal optimization of resources usage, energy oriented investments, and multifunctional management of energy consumption. The research in system frameworks of energy controlling is needed to outline its interfunctional links and interaction with the enterprise's management subsystems. Expanding scope of controlling tools contributes transparency, efficiency and manageability in the energy sector of the enterprise.

5. Methods of research

To solve the outlined problems, the following methods were used: system analysis, logical generalization, comparative analysis, monographic and graphoanalytical methods.

6. Research results

At a time when the cost of energy resources is steadily growing, enterprises and organizations get tangible competitive advantages if they measure, analyze and manage their energy efficiency. That is why, first in the business practice of European companies, and then in the scientific community, energy controlling found its place. According to the author's definition [12]: «energy controlling is an integrated system for information and analytical support of managerial decisions-making, which contributes energy efficiency, energy saving, energy security, and also focus on the enterprise's long-term life through the rational management of energy resources».

The motto «if it's not measurable it's not manageable» works also in energy controlling and means that its attention is first of all focused on the quantitative parameters of energy supply, distribution, transmission and consumption on the enterprise. Thus, energy controlling is designed to create conditions for efficient management of the company's energy resources at the operational and strategic levels. These include (Fig. 1):

– transparency of processes of supply and consumption of energy resources;
– well-founded choice of quantitative indicators that estimate the state and efficiency of activities in the energy sector of the enterprise;
– availability of energy planning;
– deviation management;
– rational organization of document flow and reporting related to energy processes.

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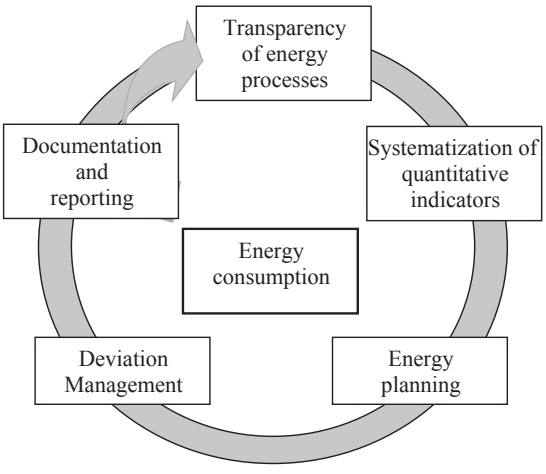

Fig. 1. Operational cycle of energy controlling

The information function of controlling is designed to ensure the transparency of the processes of energy supply and consumption. It requires collecting, process and storing large information sets. There is no need to equip each employee with a measuring device to monitor his/her own energy consumption and progress in energy saving. For the convenience of monitoring, the Pareto principle can be used. Thus, assuming that 20 % of the most powerful energy points consume 80 % of the energy in organization, the data can be collected in different ways. The best solution for permanent, relatively inexpensive, but timely and accurate metering of power consumption by industrial equipment will be the installation of stationary measuring devices. Modern equipment often already has options for measuring consumed electricity in the control settings. The received data is automatically transferred to a specially created or already existing enterprise database, where it is stored and ready for processing.

Thus, this controlling function is directly connected with transparency of energy processes at the enterprise. The operative processing and use of daily received primary information serves for monitoring of dynamics of energy costs and quickly usage of identified energy saving potential. German specialists [6] recommend using special software for managing energy databases (Energie-Daten-Management-Software). In their opinion, this special software product will significantly facilitate the monitoring tasks of controlling, and thereby provide reliable information for decision makers.

Control and analysis function serves formation of system of quantitative indicators for planning and evaluation of the progress in the energy sector. The choice of indicators is quite wide, because energy efficiency can be evaluated in various context: economic, technical, social and environmental. The priority context determines the choice of indicators.

So, in the technical sciences energy efficiency is usually calculated for new products or replacement of equipment, as the ratio of reduced amount of consumed energy to the basic amount of consumed energy. In energy audits, energy efficiency is calculated as the ratio of useful energy to total or normative (as, for example, in construction) energy consumed. That is nothing else as the energy/energy efficiency factor. In economic sciences, energy efficiency is often considered as inverse value to energy intensity. Social sciences estimate the level of satisfaction of the energy demand. In this case, the energy efficiency is interpreted in connection to the amount of energy needed to meet the demand for it, CF estimation of the energy amounts energy and mobility of the corresponding services. It means, the less energy for the same level of service was used, the higher the efficiency of the final consumption of energy resources is. From the point of view of ecologists, energy efficiency is directly linked on impact of energy production and consumption on the environment. As quantitative indicators they propose to compare the average level of destructive influence on the environment in different conditions and in dynamics, as well as the emission intensity factor for energy production.

The international standard of energy management system ISO 50001:2011 also does not give an unambiguous answer to the question of choosing one or several quantitative indicators of energy efficiency, although they are an integral part of its planning and monitoring stages. The ISO 50001:2011 provides only a general explanation of the term «energy efficiency level», which includes:

– energy consumption;
– energy use;
– energy intensity;
– directly energy efficiency and others.

It is assumed that each enterprise should independently choose suitable indicators for own use.

Planning is the most important function of both controlling and energy management in accordance with ISO 50001:2011. Energy planning has a number of special features. Firstly, it is a set of targets indicators for planning mentioned above. Secondly, energy planning should include an analysis of general activity of the enterprise, to the extent that it is connected and can affect the level of energy efficiency, energy saving, and other energy issues. At that planning should cover both direct and reverse energy flows. Finally, the planning of actions to improve energy efficiency has usually a project nature, so the planning horizon will differ for different activities, as well as investment risks associated with them.

The deviation management is an important condition for managing of energy efficiency. In addition, many practicing controllers consider it as the foundation of modern controlling. Indeed, in operational activities, most managerial decisions are connected with the arising deviations. Deviation management is used to compare planned and earned values or standard and earned/actual values; as well as to analyze the causes and consequences of deviations, preparing and implementation of corrective measures, etc. Thus, the deviation management implies a serious control over the energy processes in the enterprise.

The organization of document flows and reporting is referred to the information and coordination functions of energy controlling [7]. Their main purpose is to be the information basis for decision making. Additional bonus of regular formalized reports on energy activities is a contribution to an energy-saving corporate culture.

System analysis defines the framework as the final path for which the initial vertex of the first arc coincides with the final vertex of the last arc of the path. The system is a set of interrelated elements, isolated from the external environment, but acting with this environment as a single whole. Consequently, the system frameworks of controlling originate in goal settings, includes the systems necessary for the making and implementation of Managerial Decisions, as well as the information system (Fig. 2).

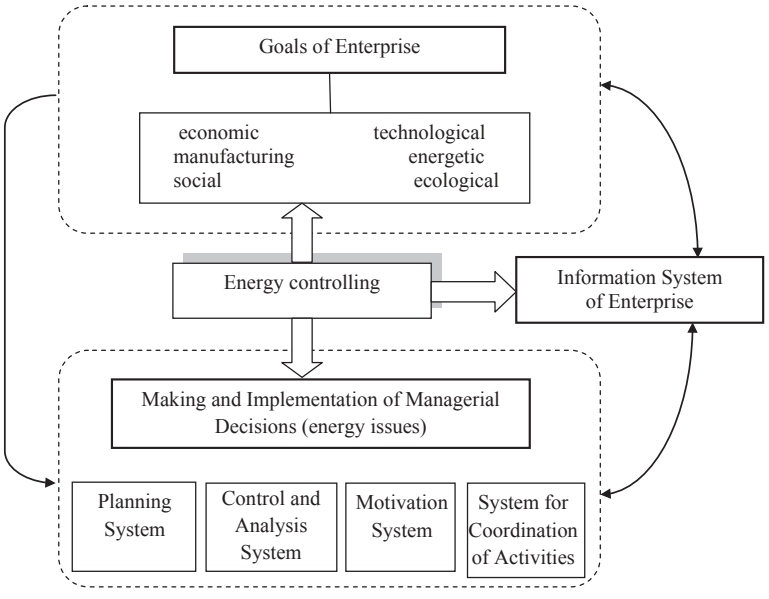

Fig. 2. System Frameworks of energy controlling in manufacturing enterprise

Thus, the system frameworks of energy controlling reduce the communication barriers within the entity to create a coherent energy policy and to implement it. Therefore, energy controlling should be considered as an integrated system that promotes the emergence of a synergy effect.

7. SWOT analysis of research results

Strengths. The strength of research is the outlined system frameworks of energy controlling. It unites the different management dimensions that affect energy efficiency, energy saving, and other energy connected issues.

Weaknesses. The lack of computation didn't allow illustrating with data the effectiveness of implementation and use of energy controlling.

Opportunities. Correspondently, the opportunities for further research cover computation and analytical models. In addition, the results of the study can be used as a basis for the development of the organizational and economic mechanism of energy controlling or a controlling mechanism for managing energy efficiency.

Threats. In case of low energy costs, it can take long time to benefit financially from energy controlling.

8. Conclusions

1. The operational cycle of energy controlling is described. This cycle includes the main stages of management of energy consumption in the enterprise.

2. The system frameworks of energy controlling are formed. Being a part of the general controlling mechanism, energy controlling integrates into the control and analytical work of the enterprise for achievement of energy goals. By its conceptual basement, it provides:

– transparency of processes and results in energy sector;

– timely information and analytical support for both operational and strategic decisions related to energy activity and development;

– optimization of allocation of companies internal resources for enhancement of energy efficiency and energy saving;

– coordination of energy goals and objectives at all levels of management, as well as a systematic, integrated solution of energy problems.

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ФОРМИРОВАНИЕ СИСТЕМНОГО КОНТУРА ЭНЕРГЕТИЧЕСКОГО КОНТРОЛЛИНГА

Проанализированы возможности применения концепции контроллинга в энергетической сфере предприятия и рассмотрены научно-практические положения ее нового направления – энергетического контроллинга, как мультифункциональной системы управления количественными параметрами энергоэффективности. На основе системного анализа был построен системный контур энергетического контроллинга, в котором очерчены межфункциональные связи и сферы его взаимодействия с управленческими системами предприятия.

Ключевые слова: энергетический контроллинг, энергетический менеджмент, энергетическая эффективность, системный контур.

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