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An Economical Significance of Energy Saving as a Component of the Strategic Development of the Ukrainian Enterprises

Tkachenko A.M.[1], Chernysheva O.M.[2], Sevast`yanov R.V.[3], Krainik O.M.[4]

[1]Tkachenko Alla Mykhailivna, Doctor of Economic Science, Professor, Head of the Department of Entrepreneurship, Trade and Stock Exchange, National University "Zaporizhia Politechnic", Zaporizhia, Ukraine, Europe
[2]Chernysheva Olena Mykhailivna, PhD in Economics, Associated Professor of Management and Finance Department, State Higher Education Institution "Ukrainian State University of Chemical Technology", Dnipro, Ukraine
[3]Sevast`yanov Rodion Viktorovich, PhD in Economics, Associated Professor of the Department of Entrepreneurship, Trade and Stock Exchange, National University "Zaporizhia Politechnic", Zaporizhia, Ukraine
[4]Krainik Olena Mykolayvna, PhD in Economics, Associated Professor of the Department of Entrepreneurship, Trade and Stock Exchange, National University "Zaporizhia Politechnic", Zaporizhia, Ukraine, Europe

Abstract

The paper considers the processes of developing and implementing a strategy for energy saving as an instrument for managing the energy efficiency of an industrial enterprise, which takes into account the conditions and peculiarities of its energy supply system operation and allows solving the key problems of efficient use of energy resources in the long run. The main types of energy-saving measures are considered which take into account the mechanism of introduction of energy technologies and influence the choice of energy-saving strategy at the industrial enterprise.

The main stages of the implementation of the energy-saving strategy have been formalized, a list of indicators and an algorithm for assessing the effectiveness of energy-saving measures have been developed. It was proved that the substantiation of energy-saving measures is reduced to optimizing the costs of their implementation. It has been proposed to use the energy balance to ensure optimization of energy-saving processes at the enterprise, the mechanism of its construction has been determined. The algorithm for the construction of the energy balance takes into account the iterative harmonization of the input and consumption of energy resources within the enterprise with the condition of providing internal technologies and needs, ensuring the plan of production and increasing production.

The article is devoted to the actual issues of developing an energy-saving strategy of the enterprise. The factors influencing energy costs and risks related to the energy efficiency of the enterprise are considered. The article describes the essence of the concept of "energy-saving strategy". The main elements of the energy-saving strategy of the enterprise are investigated and identified based on the synthesis of scientific literature.

Keywords*: Energy Saving, Enterprise Energy Efficiency, Strategy of Implementation of Energy Saving, Energy Balance of The Enterprise, Energy Resources, Energy Saving Strategy of The Enterprise.*

INTRODUCTION

Among the pressing problems facing modern enterprises of various industries of Ukraine, we can distinguish the high energy intensity of production processes and the irrationality of the use of energy resources. According to the State Agency for Energy Efficiency and Energy Conservation, Ukraine consumes about 210 million tons of fuel and energy resources annually and belongs to energy scarce countries [1]. To date, the state is meeting its energy needs by about 53% from its sources. Ukraine imports 75% of the required volume of natural gas and 85% of crude oil and petroleum products. Such a structure of energy resources is not economically viable. It creates a dependence on Ukraine's economy on oil and gas exporting countries and poses a threat to its energy and national security.

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An analysis of costs in the area of electricity generation, distribution and consumption show that most of the losses (up to 90%) are in the field of energy consumption, while losses in the transmission of electricity are only 9-10%. Therefore, the main energy-saving efforts in Ukraine should be concentrated in the area of electricity consumption. Thus, the key factor for improving the energy efficiency of production is the development and integrated implementation of organizational, technological, technical and economic and other mechanisms for the rational use of energy resources within the framework of a single strategy aimed at energy conservation.

REVIEW OF LITERATURE

The research of energy-saving issues in Ukraine, as well as the formation of mechanisms for the implementation of energy-saving measures of industrial enterprises, are devoted to the work of domestic and foreign scientists: O. Amoshi, V. Geyets, V. Jejulya, K. Ridle, R. Toud, P. Nemisha, I. Mikhailenko, T. Afonchenkova, V. Bevza, K. Dokunina, T. Serdyuk, Ram Gopal & other, Y. Chistova, Y. Vovk, I. Ippolitova and others [2-12]. To ensure the systematic, coherent and control of the measures implemented within the framework of the enterprise's energy policy, mechanisms for managing energy-saving processes and improving energy efficiency must be formalized and take into account a set of factors. However, despite the accumulated experience (both domestic and foreign), the implementation of energy-saving projects and the formation of a regulatory framework for managing the energy efficiency of industrial enterprises is situational.

Therefore, the purpose of this article is to develop an energy-saving strategy that takes into account the conditions and peculiarities of the functioning of energy systems of industrial enterprises and allows to solve the key problems of efficient use of energy resources in the long term.

Finding the optimal configuration of opportunities in the face of existing economic, environmental and social constraints in energy policy is a complex problem and a real driver for developing a comprehensive strategic vision.

RESEARCH METHODOLOGY

Despite the considerable amount of thorough research, this problem cannot be fully resolved, since the issues related to defining the essence of both the energy-saving strategy of the enterprise and the elements that form it remain insufficiently investigated.

The purpose of the article is to explore approaches to determining the essence of an enterprise energy conservation strategy, as well as to identify the constituent elements that shape it, based on the generalization of scientific literature.

The developed program of energy saving of industrial enterprises does not guarantee success, and the company that creates it may encounter failure due to mistakes in the organization, motivation and control system. The energy conservation program for industrial enterprises must be holistic but also flexible. Knowing what an organization wants to accomplish will help clarify the most effective ways to solve problems. By making sound and systematic planning decisions, management reduces the risk of making the wrong decision due to erroneous or false information about the organization's capabilities or the external market situation.

The theoretical, scientific and methodological basis of research became methods of scientific knowledge, general scientific principles, and experience in the field of energy-saving of enterprises. The following scientific methods are used to solve the set tasks in the article: theoretical generalization, comparison, co-evolutionary approach, and conceptual provisions “Environmental economics”.

RESULTS

It must be understood that energy efficiency and energy conservation are key concepts for ensuring the efficiency of both business and the state as a whole. At the same time, the industry is the first victim of the misuse of resources, as this harms the cost of production. Energy-saving is a set of organizational, legal, industrial, scientific, economic, technical and other measures aimed at rational use and economical consumption of fuel and energy resources. Energy intensity of production is the amount of energy and fuel consumption for the basic and auxiliary technological processes of production, the performance of works, provision of services based on given technological systems.

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Business efficiency is built on the balance of income and cost of production, which inevitably includes the cost of energy consumed – thermal, electrical or other. And the lower these costs, the more efficient the business. The less energy consumption, the higher the energy efficiency. Energy conservation in any field is reduced to the rational use of energy, reducing unproductive losses.

The main reasons for the low energy efficiency of enterprises are significant physical and moral deterioration of fixed assets and, as a consequence, high equipment failure; low level of control and regulation of energy consumption; increased losses in production processes and high consumption of primary fuel and energy resources; lack of qualified specialists in the field of energy management; low level of motivation of staff to save energy and so on.

Naturally, the attitude of the management of the company to energy saving is determined by the share of costs for energy resources in the cost of production. And if in the chemical industry the share of energy costs can reach 40%, then for mechanical engineering this figure, as a rule, ranges from 6-15%. Accordingly, energy conservation activity in the chemical industry should be an order of magnitude higher.

There are main types of energy-saving measures:

1) Organizational measures – quick payback measures – internal energy audit, a compilation of the energy passport of the enterprise, development of energy-saving measures and increase of efficiency of technological processes, monitoring of the implementation of the adopted measures of stimulation and motivation of energy-saving behaviour, the introduction of the right to use the funds from energy saving of energy resources, technologies. Rapid return measures can be developed and implemented within a year and have a significant effect at low cost;

2) Technological measures – basic measures – are more radical and facilitate the rapid implementation of cost-effective and financially attractive investments. Provide the introduction of energy efficiency standards in the use of industrial buildings, industrial equipment, the introduction of recycled water supply systems, window cleaning, painting the walls of rooms with light paint, the use of waste heat refrigerators and air conditioners for heating water, the introduction of frequency control systems and other systems. in ventilation systems, pumping stations and other AC facilities. But energy-efficient projects may require financial support from banks and leasing companies;

3) Investment measures – high-cost and high-efficiency measures help to address the root causes of low energy efficiency, in most cases guaranteeing more significant energy savings but requiring higher upfront costs. This is first and foremost the transition to alternative sources of energy supply and the use of modern energy-saving production technologies. Also, organizational changes at the level of the country and the region, such as pricing reform, improvement of electricity and gas markets, the transition to integrated planning of different sources of energy supply, were of great importance for the implementation of this group of measures.

In the process of modernization, industrial enterprises should implement the following types of technologies that have a significant energy-saving effect:

- Common technologies for many businesses related to energy use (variable speed motors, heat exchangers, compressed air, lighting, steam, cooling, drying, etc.);
- More efficient production of energy, including modern boiler rooms, cogeneration (heat and electricity), as well as tri-generation (heat, cold, electricity);
- Replacement of old industrial equipment with new, which consumes much less energy;
- Alternative Energy Sources.

Energy-saving mode is especially relevant for the mechanisms that work part-time with reduced load – conveyors, pumps, fans. Many devices can reduce the loss of electrical equipment, the main of which are condenser units and frequency adjustable actuators, which can be implemented in most industrial enterprises.

The implementation of an energy-saving strategy helps the company avoid risks and gain a competitive advantage over other companies that present their products or services in the market. This strategy should be the basis for effective management of energy conservation processes within the framework of long-term energy, economic and innovation policy of the enterprise.

German researcher J. Kals in his work [13, p. 182-184] outlines the following typical strategies that can be applied to the strategic modelling of an energy conservation system in an enterprise:

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- Passive strategy – there is no systematic planning and energy management is not considered as a separate target. The tasks of energy policy formulation and the application of international energy conservation standards are not relevant to the enterprise, but rather are ancillary to finding ways to survive the enterprise in the highly competitive environment;

- strategy for maximizing profits in the short term – implementing energy-saving measures with relatively short payback periods and high returns. The strategy focuses on solutions that have already shown their effectiveness, are more standardized and proven, and their implementation does not lead to additional problems in the form of additional training of employees, improving the efficiency of the introduction of new technologies. Low yield measures are not considered;

- The strategy of maximizing profits in the long term involves a serious understanding of the energy market and technology development, management takes into account energy-saving projects with a large payback period. Appropriate measures (for example, the introduction of new power plants or heat exchangers) can take several decades to complete;

- Considers the strategy of implementation of all attractive investment measures as the purpose of applying the whole set of possible measures in the field of energy consumption optimization, which have a positive economic effect both in the short and long term;

- The maximum strategy implies that even entire businesses may change the interests of energy conservation and climate protection. The company joins both applied energy efficiency studies with a long payback period and basic research, for example, in the field of alternative energy.

The choice of one or another energy-saving strategy depends, first of all, on the goals of the enterprise and its potential capabilities to implement the strategy. Also, in the context of economic independence of enterprises, one of the main criteria for choosing a strategy for implementing energy-saving technologies and stimulating the processes of implementing energy-saving measures is to evaluate their economic efficiency.

The main effects of the implementation of the energy-saving strategy of an industrial enterprise can be attributed to:

- Increase of productivity of technological installations and equipment in case of implementation of measures on technological energy saving, reduction of energy consumption per unit of production and improvement of its quality;

- Saving energy and other resources, which leads to lower material costs and cost of production;

- Reduction of payments of the enterprise for environmental pollution due to the decrease in the amount of spent fuel and energy resources.

But there can be negative results:

- Growth of the total volume of fixed assets of the enterprise;

- Increase in material costs (despite the saving of energy resources);

- Increase in operating costs for maintenance of energy-saving equipment and installations;

- Increase in the number of staff, etc.

The implementation of an energy conservation strategy at the enterprise should provide a comprehensive approach to the management tasks and a clear formalization of each of its stages.

1. Formation of a set of targets calculated based on indicators (parameters of the energy state of the enterprise). Targets are needed to plan and evaluate the efficiency of the energy-saving processes of the enterprise and its structural elements (energy systems, units, buildings, etc.). Therefore, they reflect the planned and actual levels of implementation of strategic objectives and are subject to annual correction, taking into account several factors: the actual deviation of the indicators from the set values for the reporting period; assessing the actual effectiveness of energy-saving measures; changes in the level of technical and technological development; estimates of the economic situation and others.

2. Planning and implementation of point and comprehensive measures in the field of energy-saving. The mechanism of implementation of measures should have a clear interconnected algorithm of actions with a clear predictable result, comply with state and industry normative legal documents, correlate with the target programs and decisions previously adopted at the enterprise. Contractors, volumes and sources of funding, as well as funding schemes, should be identified for each event.

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Taking into account the time constraints set by the strategy, a schedule of implementation of measures is formed.

3. Control of energy-saving processes. The strategy requires the implementation of an effective system of monitoring, analysis and decision-making in the enterprise, which ensures the division of areas of responsibility for the implementation of measures, as well as the adaptive management of energy-saving processes taking into account the possible risks and other factors of organizational, technical, social and economic nature.

Achieving a positive effect from the use of energy-saving measures can be estimated based on an estimate of energy savings in quantitative and cost terms. To compare the current economic performance of enterprises before and after the implementation of energy conservation measures of the total amount of profit remaining at the disposal of enterprises, the part thereof, the change of which is directly caused by the implementation of energy-saving measures, is determined by the formula:

$$\Delta P_t = Cf_t * \Delta Qf_t + Ch_t * \Delta Qh_t + Ce_t * \Delta Qe_t + \Delta E_t - (C_t + n * I_t) + \Delta Z_t \quad (1)$$

Where Cf_t – – is the price of saved conventional fuel at current tariffs in year t, UAH / tp.

ΔQf_t – reduction of the supply of conditional fuel to the enterprise in year t, tp / year;

Ch_t – - tariff for the purchase of heat in year t, UAH / GJ;

ΔQh_t – reduction of heat consumption from the side in year t by implementing energy-saving measures, GJ/year;

Ce_t – - tariff for electricity received from the country's grid in year t, UAH / kWh;

ΔQe_t – reduction of electricity consumption from the grid in year t by implementing energy-saving measures, kWh / year;

ΔE_t – reduction of payments of the enterprise for environmental pollution in year t, which is conditioned by the implementation of energy efficiency measures, UAH / year;

C_t; I_t – - current costs and capital investments in year t related to the purchase, installation and operation of energy-saving equipment, UAH;

n – is the internal rate of return;

ΔZ_t – reduction of operating costs at the enterprise in year t, which are caused by the implementation of energy-saving measures, in addition to the costs of maintenance of energy-saving equipment, UAH / year.

Thus, the energy efficiency of an energy conservation event Ej can be calculated by the formula:

$$E_j = E\left(\frac{1}{1-\frac{\Delta P}{P}}\right) \quad (2)$$

Thus, energy efficiency after an energy conservation event is a complement to the initial energy efficiency by a factor that depends on relative energy conservation. This coefficient shows how many times the energy efficiency of the considered beneficial effect increases with a relative energy saving of ΔP / P.

Also, indicators of the effectiveness of the strategy of implementing energy-saving technologies in an industrial enterprise include:

- The efficiency of the power plant;
- Energy efficiency factor;
- Coefficient of energy efficiency by individual types and parameters of energy carriers;
- Specific (actual) energy consumption;
- Specific consumption of energy resources per unit of output and their components by energy sources (electricity, fuel, and water).

Thus, the task of justifying energy conservation measures is to optimize their costs. As energy efficiency measures are long-term, this is complicated by price volatility. In the conditions of

inflation, optimization should be carried out against the background of forecasting economic development and prices for fuel and energy resources.

One of the main organizational documents for optimization of energy saving processes in the enterprise is proposed to consider the energy balance, which, in addition to the traditional data on the amount of energy consumption, must include data on the efficiency of all external energy sources and information on internal directions of energy costs. Based on these data, the optimal structure of the income side of the energy balance is formed by selecting energy sources, taking into account global and local constraints. On the other hand, the profit part of the energy balance of the consumer enterprise determines the result of the aggregate technological process of its energy supply. Within industrial enterprises, the energy balances of workshops and industries can be considered in more detail, down to individual units and technological operations. It is also possible to raise the issue of the energy hierarchy.

To organize continuous work on optimization of energy costs, an algorithm for forming the energy balance of an industrial enterprise. Is proposed, taking into account energy-saving projects. The proposed algorithm takes into account the iterative reconciliation of the receipt – consumption of energy resources within the enterprise with the condition of providing internal technologies and needs, providing a plan of production and increasing the volume of production.

CONCLUSIONS

Thus, the main features of the implementation of the energy-saving strategy at Ukrainian industrial enterprises are:

- Systematic and clear algorithm of actions;
- Control and monitoring of the efficiency of energy efficiency measures;
- Adaptability to changes within the enterprise and in the external environment;
- Consistency with previously adopted strategies, target programs and management decisions;
- Compliance with the main provisions of regulatory documents, as well as the energy policy of the company.

Practice shows that industrial enterprises are not ready for the difficult task of developing an energy conservation program. Within the existing structures, no one should do this work. As many industrial enterprises lack qualified personnel in the field of energy conservation, it is necessary to train the employees of the enterprises for the implementation of the adopted energy conservation programs.

Formation of energy-saving programs at industrial enterprises will provide transition of the Ukrainian industry to an energy-efficient and non-subsidized development path in the budgetary sphere. Careful accounting of fuel and energy resources, their economy, normalization, optimization of energy balance, the introduction of innovations, improvement of scientific-innovative, information bases will give able to reduce the costs of industrial enterprises for the acquisition of fuel and energy resources. Encouraging energy efficiency will be the key to increasing its competitiveness of domestic industrial enterprises in the world market.

REFERENCES

1. Decree of the Cabinet of Ministers of Ukraine “On approval of the state target economic program of energy efficiency and development of the sphere of production of energy sources from renewable energy sources and alternative fuels for 2010-2016” [Electronic resource]. – Access mode: http://zakon2.rada.gov.ua/laws/show/243-2010-%D0%BF.
2. Afonchenkova T.M. Formation of economic mechanism of energy saving by agricultural enterprises: author. diss. / T.M. Afonchenkova; SEE of Europe. Univ. – K., 2008. – 22 p.
3. Bevz V.V. Development of energy-saving mechanism at food industry enterprises / V.V. Bevz // scientific notes: Coll. of sciences work. – K.: KNEU, 2011. – № 13. – pp. 169-173.
4. Geyets V.M. Development and interaction of economic and energy policy in Ukraine / V.M. Geyets // Bulletin of the National Academy of Sciences of Ukraine. – 2016. – № 2. – pp. 46-53.
5. Gordienko O.S. Energy Saving of Transport Enterprises / O.S. Gordienko // Technological audit and production reserves. – 2012. – № 1 (7). – T. 5. – pp. 13-14.

6. Jejula V.V. Energy saving of industrial enterprises: formation methodology, control mechanism: monograph / V.V. Jejula. – Vinnitsa: VNTU, 2014. – 346 p.
7. Dokunina K.I. Theoretical aspects of the formation of the economic mechanism of energy saving / K.I. Dokunina // Utilities of the cities – 2012. – № 106. – pp. 341-350.
8. Ippolitova I.Ya. Formation of organizational-economic mechanism of energy saving at the enterprise / I.Ya. Ippolitova, K.C. Sorokotyazhenko // Global and national problems of economy. – 2015. – Issue 8. – pp. 406-411.
9. Mikhailenko I.D. Energy Saving Policy, Potential Energy Saving Potentials in Ukraine / I.D. Mikhailenko // Energy saving. – 2006. № – 1. – pp. 3-8.
10. Nemish P.D. The essence, estimation and directions of increase of efficiency of the mechanism of energy saving of agrarian and industrial complex / P.D. Nemesh // Innovative Economics. – 2013. – No. 7 (45). – P. 46-53.
11. Serdyuk T.V. Organizational and economic mechanism of energy saving in industry: monogr. / T.V. Serdyuk. – Vinnytsia: UNIVERSUM-Vinnytsia, 2005. – 154 p.
12. Chistov Yu.I. The essence of the mechanism of energy-saving and its multifaceted nature / Yu. Chistov // Bulletin of the Khmelnytsky National University. Economic sciences. – 2010. – № 5. – pp. 341-44.
13. Kals J., Würtenberger K. IT-unterstütztes Energiemanagement in: HMD – Praxis der Wirtschaftsinformatik HMD, Heft 285/2012. pp. 73-81.
14. Gnidiy M.V. Methodology for determining the theoretical potential of energy saving at different levels of economic management / M.V. Gnidiy, O.E. Malyarenko // Problems of general energy. – 2007. – № 15. – P. 1-21.
15. Vovk Yu. Organizational-economic mechanism of management of rational use of resources [Electronic resource] / Yu. Vovk // Socio-economic problems and the state. 2011. 1 (40). – Access mode:http://sepd.tntu.edu.ua/images/stories /pdf/2011/11vyyrvr.pdf.
16. Ahmed M. Hussen Principles of environmental economics and sustainability: an integrated economic and ecological approach: London [u.a.]: Routledge, 2013 – 417 p.
17. Daly H.E., Farley J. Ecological Economics: Principles and Applications: Island Press, 2010 – Secodition. – 539 p.
18. Ram Gopal, Serdar Vural UYGUN, Sandeep Kumar Gupta, Inna Tsvigyn and Laodiceia Amorim Weersma, Svitlana Ilinich, Rainu Gupta, Sustainable Development and Intelligent Real-Time Vehicle Mileage Calculation Device, International Journal of Recent Technology and Engineering, ISSN 2277-3878, Vol 8, Issue 1S4, 2019, Pp 1043-1045