

# Forming the Energy Security Strategy of Modern Industrial Enterprises

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**Abstract** The article justifies the need and practicality of implementing the strategy, which will coordinate the actions of top management of enterprises in solving the reduction of product energy intensity and the decrease in energy consumption and energy dependence. The article aims to analyze theoretical approaches to forming the energy security strategy of modern industrial enterprises, identify the main stages in strategic management of enterprises' energy security and clarify which tools should be applied to form such a strategy. The article uses the following research methods: graphical methods – to clearly reflect the process of forming the energy security strategy of modern industrial enterprises; analysis – to specify the role of the energy security strategy in the system of functioning of the enterprise; theoretical generalization – to justify the list of energy security strategies. It is suggested to introduce the energy security strategy of modern industrial enterprises, which is based on the combination of such principles as integrity and systematicity and also takes into account the interrelation between the general strategy for enterprise development, normative and legal regulation of energy supply and energy consumption of the enterprise. The article justifies the need to develop an effective mechanism for increasing the level of energy security based on strategic management to deal with the threats of external and internal origin.

**Keywords:** *strategy, energy security, energy efficiency, enterprise.*

## I. INTRODUCTION

Nowadays, energy efficiency is an extremely important criterion for the functioning of the economic model of enterprises. The most thorny issues include stable energy supply and efficient use of energy resources, which are mostly based on the integrated approach to managing energy consumption and forming the energy security strategy. Energy security plays an essential role in the system of effective enterprise management since it is an integral part of its strategic development, depending on the goals and conditions of management, as well as the means and possibilities of their achievement. It is one of the most important components of economic security, which is manifested, firstly, as the condition of providing the enterprise with fuel and energy resources which guarantee its full functioning and, secondly, as the security of the energy economy and its ability to ensure normal functioning of enterprises.

Therefore, it is vital to introduce such a strategy which will coordinate the actions of top management of enterprises in solving the reduction of product energy intensity and the decrease in energy consumption and energy dependence.

### The Essence of the Energy Security Strategy

The economic literature interprets the concept of strategy as follows:

- the aim of management (an ideal model of the enterprise, which realizes the vision of its managers, owners, etc.);
- the position in the markets (first of all, competitive participation in the markets and conquest of new markets);
- a standard (the enterprise's striving for the perfect);
- expected results, areas of development, perspective views on the future condition of the enterprise, actions in the competition;
- a way of identifying the main long-term goals and objectives, approving a course of action, allocating resources necessary to accomplish the set objectives;
- a general comprehensive plan for achieving goals;
- a long-term course of enterprise development, a way of achieving goals;
- a range of decisions about the allocation of resources and the achievement of long-term competitive advantages in the target markets;
- a generalized programme of activities aimed at achieving the aim through the efficient allocation, coordination and use of resources [1].

The energy security strategy of the enterprise can be presented as a process which involves forming a general high-potential energy-efficient development of the enterprise based on the identification of goals of energy conservation, reconciliation of the internal capabilities of the enterprise with environmental conditions and elaboration of relevant energy-efficient measures which can ensure their achievement. The energy security strategy of the enterprise implies its continuous coordination based on a comprehensive analysis of current processes and promising

research. It is aimed at determining the goals, areas, sources and objects of energy supply and is intended to ensure:

- the accumulation and efficient use of energy resources;
- the achievement of high-level energy security in the enterprise;
- the identification of alternative ways of energy usage and diversification of energy consumption;
- the compliance of the energy supply and consumption system with economic development and functioning of the enterprise;
- the development of an effective system of threat and danger management;
- the optimal selection of energy efficiency technologies which allow the enterprise to be competitive.

## II. LITERATURE REVIEW

Some important aspects of forming the energy security strategy have been studied by many international and Ukrainian scholars. According to [2], a firm's enterprise strategy is its overarching strategic orientation, addressing questions regarding its general purpose and the specific nature of its relationships with stakeholders along two dimensions: (a) scope, which represents the range of stakeholders the organization attempts to serve, and (b) type, which represents the general motivation behind stakeholder initiatives. M. Porter [3] believes that a strategy implies creating a unique and advantageous position which involves a certain set of activities. If there existed only one ideal position, there would be no need for any strategy. H. Mintzberg [4] singles out five definitions of strategy: a strategy as a plan – a system of sequential actions; a strategy as a position – a way of determining the organization's place in the external environment and in relation to its main competitors; a strategy as “a smart way”; a strategy as a principle of behaviour; a strategy as a current prospect. I. Ansoff [5] considers a strategy to be a set of rules needed for decision making.

M. Meskon et al. [6] believe that a strategy is a detailed and comprehensive plan designed to ensure that the organization accomplishes its mission and achieves its goals. Both successful functioning and economic development of industrial enterprises largely depend on the level of their energy security. B. Stackpole & E. Oksendahl [7] analyze six keys to successful strategic security planning. They believe that such an approach utilizes a holistic view of security; this is not the traditional view of security. Holistic security seeks to understand the impact of security issues on the entire enterprise. Holistic security functions as a fully integrated part of an organizational system. The assumption is that systems have to be understood as wholes rather than as a sum of their parts. This includes technology, processes, information, and, most importantly, people.

L. Haar & L. N. Haar [8] describe the energy security strategy in political, engineering/geologic or economic context. The paper of B. W. Ang & W. L. Choong [9] reports the findings on the following: energy security definitions, changes in the themes of these definitions, energy security

indexes, specific focused areas and methodological issues in the construction of these indexes, and energy security in the wider context of national energy policy. It is found that the definition of energy security is contextual and dynamic in nature. T. Oleksiuk [10] indicates that a well-developed strategy is an effective tool for managing energy security of the enterprise in the long run, which is oriented towards the implementation of the overall goals of the enterprise development in a dynamic environment and the associated uncertainty. T. Sak [11] regards the essence of energy security in the enterprise as the level of the protection of the enterprise and its energy supply from external and internal threats under the conditions of its normal functioning, taking into account the prospects of development, as well as the supply of the minimum required energy needs in an emergency. A. Shydlovskiy et al. [12] believe this category to be one of the most important components of economic security, which manifests itself as a condition of providing the state with fuel and energy resources that guarantee its full-fledged activity or as the security of energy sector and its ability to ensure the normal functioning of the economy, as well as the energy independence of the country. Political and energy independence are interrelated. M. Voynarenko & O. Mykolyuk [13] have designed a hierarchic model of factors influencing energy security in the enterprise, which makes it possible to comprehend the interaction between these factors, their interconnections and impact on energy security in the enterprise. This ultimately leads to the development of certain optimal / agreed management decisions in the context of forming and ensuring energy security in the enterprise. O. Mykoliuk & V. Bobrovnyk [14] prove that the main tool for ensuring energy security in the enterprise is the increased use of renewable energy.

## III. MATERIALS AND METHODS

Therefore, the energy security strategy of enterprises should be developed based on a combination of such principles as integrity and systematicity and also take into account the interrelation with the general strategy for enterprise development, legal regulation of its energy supply and energy consumption of the enterprise. In this context, one should pay considerable attention to the development of the energy market, the political and economic situation of the country and the relationship with importers of energy resources, as well as the availability of the country's energy carriers, energy and technology equipment of the enterprise. L. Ptashchenko [15] and O. Liashenko [16] consider certain stages and principles of forming the strategy for enterprise development. However, they state that there is no mechanism for forming and ensuring energy security in enterprises to increase their level. To identify the ways of increasing energy security in the enterprise, the authors of the paper justify the need to develop an effective mechanism for increasing the level of energy security based on strategic management to deal with internal and external threats. The threat of decreasing energy security in enterprises is caused by the inertia of their production structure, wear of equipment, technological backwardness. In this context, the need to develop an effective mechanism for increasing energy security is of paramount importance.

#### IV. RESULTS AND DISCUSSION

According to the author's concept, the strategy is a system for ensuring energy security in the enterprise in the long run and includes certain interrelated components united

by the common goal to maximize the level of energy security. The energy security strategy of the enterprise should be developed taking into account the following blocks (see Fig. 1).

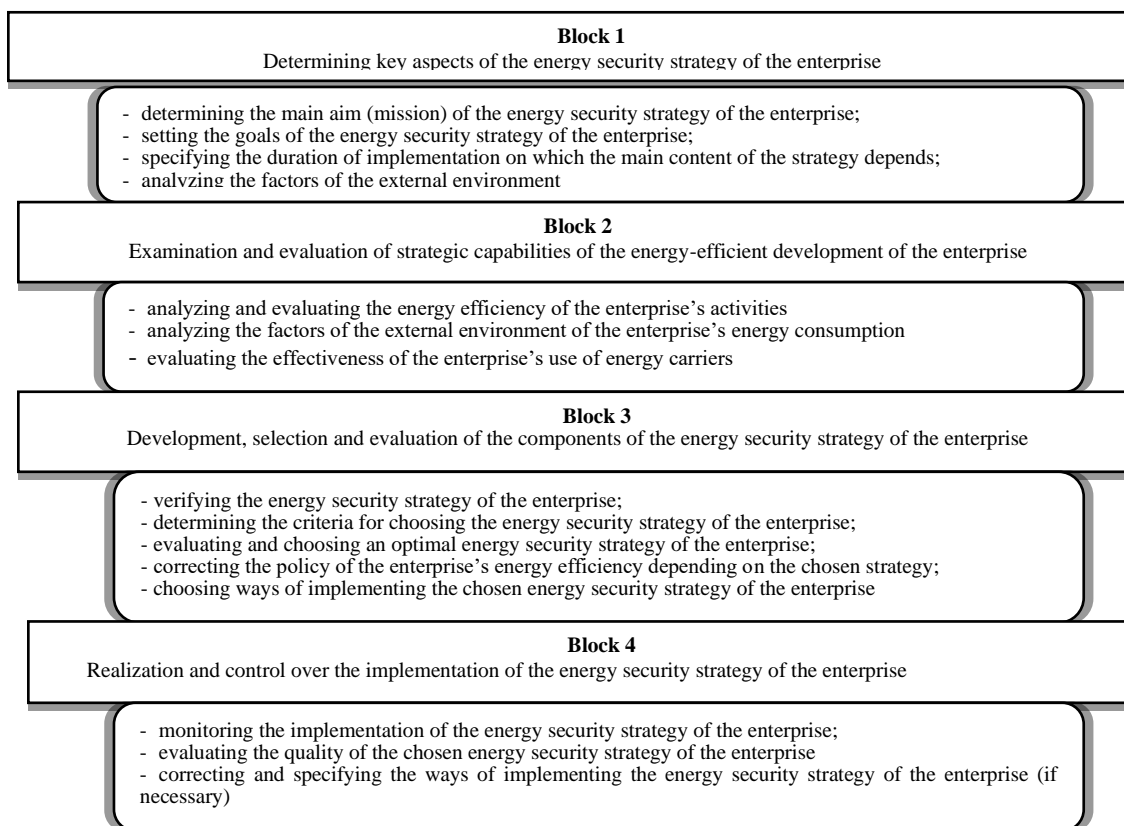


Fig. 1. The model for forming the energy security strategy of industrial enterprises (author's development)

The energy security strategy of the enterprise is implemented due to the energy efficiency of the enterprise management system. Its key elements involve the principles of its forming and modelling. The principles of management based on energy efficiency reflect the rules of the energy conservation policy of the enterprise.

It must be noted that some possible changes in the enterprise management system cause the transformation of the main elements of forming the energy security strategy of the enterprise. The process of forming such a strategy consists of four stages, which are presented as the corresponding blocks. They serve as the foundation of the model for forming the energy security strategy of the enterprise.

As for forming the energy security strategy of the enterprise, the key elements of the blocks are the following:

- determining the main aim (mission);
- setting a system of goals (objectives) which form an energy-efficient component of the enterprise;
- specifying the duration of implementation on which the main content of the strategy depends;

- analyzing environmental factors which determine the goals and content of the future strategy.

##### A. Examination and Evaluation of the Energy Security Strategy

The processes of examining and evaluating strategic capabilities of energy-efficient development of the enterprise are based on the following:

- analyzing and evaluating the energy efficiency of the enterprise to determine its condition and features of its development;
- analyzing the factors of the internal energy environment to identify their influence on the effective indicators of the enterprise's energy consumption;
- evaluating and studying the energy consumption of the enterprise to provide strategic opportunities for energy-efficient development of the enterprise.

In this context, the key elements include developing alternative strategies; justifying the system of factors in selecting strategies; evaluating and selecting some optimal strategies; justifying certain ways of implementing these

strategies. The process of realizing and controlling (monitoring) the implementation of the developed energy security strategy implies monitoring the implementation of the strategy, establishing the level of obtaining the actual interim and final results in relation to the expected ones and correcting its shortcomings.

This block involves evaluating the quality of the strategy as for increasing the level of the enterprise's energy security, which is based on the analysis of quantitative and qualitative indicators.

This approach makes it possible to comprehensively characterize the results obtained from the implementation of the strategy, the energy efficiency of the enterprise and make some adjustments if necessary.

Following the developed model for forming the energy security strategy of industrial enterprises, the authors of the paper suggest distinguishing seven types of strategies based on seven levels of the enterprise's energy security determined by the evaluation of the integrated level of energy security.

Therefore, the energy security strategy of the enterprise will consist of the following types of strategies: growth strategy, moderate growth strategy, stabilization strategy, reload strategy, transformation strategy, survival strategy, anti-crisis strategy.

#### B. The Set of Energy Security Strategies of Enterprises

The growth strategy implies maintaining the achieved level of energy security, monitoring and controlling the results of activities and preventing the emergence of possible threats to the economic interests of machine-building enterprises. Its implementation involves optimizing the structure of energy resources use, introducing technologies based on renewable energy sources and their high energy efficiency of consumption and updating and reconstructing the enterprise's fixed assets. The moderate growth strategy involves supporting further development of the energy infrastructure, ensuring the implementation of a system for monitoring energy security, improving preparedness for possible threats and coordinating plans and actions of the enterprise about the existing possibilities of energy consumption diversification.

The stabilization strategy is used under the conditions of instability, reduction of energy efficiency and threats to the level of energy security of the enterprise. It aims to use an adaptation mechanism to eliminate the threats, reduce the level of risks to the energy system of the enterprise and improve the energy management system.

The reload strategy requires that the obstacles to improving energy efficiency should be comprehensively analyzed, relevant measures should be taken to eliminate them and active and balanced energy policy should be developed. The transformation strategy is designed to ensure clear accounting for all forms of energy and fuel and energy resources (electricity and heat energy, natural gas, etc.), contribute to forming and monitoring the energy balance of the enterprise, evaluating the efficiency criteria and, finally, facilitate the conditions for reducing the energy intensity of the products. The survival strategy should ensure the energy stabilization of the enterprise in critical situations, include a

reduction in production and sales (leaving individual markets or their segments, reducing its certain production units, etc.). Under these conditions, it is important to form a sufficient level of energy security of the enterprise.

The anti-crisis strategy involves implementing a set of actions and consistent management decisions which make it possible to evaluate, analyze and develop the necessary system of influence on energy security of the enterprise to prevent bankruptcy or minimize the effects of the crisis. The main aim of the anti-crisis strategy is to stabilize the activities of the energy subsystem of the enterprise, eliminate the contradictions between the elements of the microeconomic system and the external environment to restore an acceptable level of energy security.

Choosing the energy security strategy of the enterprise, one can choose relevant tactical measures as well. Tactic and strategy for managing energy security should be interrelated. The tactic is a concrete short-term strategy. The policy is a general guide for action and decision-making. Procedures include actions which should be done in a particular situation. Rules accurately indicate what needs to be done in a particular situation.

Following the chosen strategy, the enterprise will be able to identify a new concept of energy recovery. Based on this concept, programmes for energy conservation, energy efficiency and energy security are developed. They can help to discover ways how to recover from a crisis.

Provided that operational measures to recover from the economic crisis are taken in isolation from strategic objectives, this can lead to short-term improvement of energy efficiency. Still, it will not resolve the root causes of the crisis.

Proving the need to justify and choose the energy security strategy of the enterprise, one should evaluate the effectiveness of such a strategy. Such scholars as A. Cherep & A. Suchkov [17], V. Babenko et al. [18], L. Malyarets et al. [19], O. Novikova & R. Pokotylenko [20] have studied the evaluation of the effectiveness which boils down to whether the chosen strategy will achieve the set goals. The authors of the paper consider it necessary to evaluate the strategy for increasing the level of energy security in the following areas (see Table I).

TABLE I. AREAS IN THE EVALUATION OF THE EFFECTIVENESS OF THE STRATEGY FOR INCREASING ENERGY SECURITY

Area	Effectiveness
The accordance of the condition and requirements of the environment with the chosen strategy	One evaluates the accordance of the strategy with the variability of the environment, clarifies how factors in the dynamics of the energy market and the product life cycle are taken into account and specify whether the implementation of the strategy will result in new competitive advantages
The accordance of the potential and capabilities of the enterprise with the chosen strategy	One evaluates the accordance of the strategy with the potential of the employees, financial resources of the enterprise, technological energy-efficient equipment and specifies whether the existing structure of the enterprise makes it possible to successfully implement the strategy
The adequacy of the risk inherent in the strategy	One evaluates whether the risk is warranted in the context of the following three areas: the realistic preconditions on which the chosen strategy is based; negative consequences for the enterprise, which can lead to failure of the strategy; justified losses in case of the strategy's failure

the author's development was based on [16-17; 20-25]

The process of evaluating the effectiveness of the energy security strategy of enterprises can be described through three areas, while the objectivity of the evaluation will depend on the completeness, quality and reliability of the information used.

In view of this, it is important to compile an array of strategic vectors within each strategy to increase the level of energy security of enterprises, which will serve as a criterion

for the effectiveness of the strategy and implementation of opportunities for enterprises with lower levels of energy security and will provide an opportunity to increase the level of energy security and move on to implementing a strategy of the highest level security.

Table II suggests some strategic vectors for improving energy security in accordance with the strategies.

TABLE II. STRATEGIC VECTORS FOR INCREASING ENERGY SECURITY OF MACHINE-BUILDING ENTERPRISES

Strategy	Vectors for increasing energy security
Growth strategy	supporting the growth of production under further reduction of product energy intensity; introducing energy-efficient technologies that ensure the competitiveness of the enterprise's products; controlling and optimizing management expenses; introducing large-scale technologies based on the use of renewable energy
Moderate growth strategy	maintaining a strong position in the market; controlling and evaluating the level of energy security with the objectives of the enterprise; using energy-efficient technologies and investments; updating and improving energy consumption accounting systems
Stabilization strategy	adjusting energy efficiency indicators to their subsequent increase; adapting to the conditions of a changing environment; delaying the decrease in the volume of sales and profits; developing a long-term stabilization programme, reducing all kinds of expenses; attracting investors
Reload strategy	diversifying energy supply; improving the system of enterprise energy management; updating technological equipment; optimizing expenses of the enterprise; minimizing the negative effects of the current changes, as well as factors of uncertainty in the future
Transformation strategy	collecting the necessary information to make management decisions to ensure the further functioning of the enterprise; implementing effective motivational transformations and controlling energy consumption indicators; ensuring the dynamism of the changes through the implementation of energy conservation plans based on the appropriate system of regulation, control and analysis
Survival strategy	consolidating efforts of managers all levels and activities of the enterprise units related to the provision of energy security in the enterprise; taking measures to optimize energy efficiency policies of the enterprise to certain economic conditions; reducing expenses; improving the policy of attracting borrowed funds; eliminating unprofitable areas of the enterprise's activity
Anti-crisis strategy	taking economic, legal, industrial and technical measures aimed at changing the structure, management system which can restore profitability, competitiveness and production efficiency; choosing the strategic ways of recovering from the crisis; reducing expenses related to production and sales, maintenance of fixed assets and employees; taking appropriate operational measures, in particular, reduction of losses, identification of internal reserves, personnel reshuffles, strengthening of discipline

## V. CONCLUSION

Based on the results obtained from determining strategic vectors of energy security of industrial enterprises, one can conclude that the process of forming an adequate and effective strategy for energy security in the enterprise involves analyzing theoretical, methodological, functional and organizational issues in the following areas:

- the structured model of the strategy for increasing the level of energy security in the machine-building enterprises;
- the description of the main factors which determine the parameters of the strategy;
- the main quantitative indicators used in the strategy for increasing the level of energy security in the machine-building enterprises;
- the use of complex methods when analyzing the strategy for increasing the level of energy security in the machine-building enterprises.

Therefore, energy security is a very important and acute problem, the study of which can make a significant step towards improving the capabilities of industrial enterprises.

The development and implementation of the energy security strategy of enterprises are of great practical importance in ensuring their stable activities in the current and strategic periods. Provided that the management of the enterprise has sufficient information about the competitive status of the enterprise and the features of external interaction and internal structure, they can determine a strategy which will contribute to achieving strategic goals of the enterprise. Strategic management of energy security should be considered as a process of managing strategic planning and the developed energy security strategy of enterprises, taking into account the interconnection between the internal environment of the enterprise with the external one, as well as the adaptation to their changes in order to achieve the goal of the enterprise and protect it from the influence of threats and risks.

The strategic approach to managing energy security of enterprises has several advantages which make it possible to minimize the influence of negative factors, increase the awareness and certainty in the future of the enterprise, ensure the manageability and efficiency of changes and achieve the goals of the enterprise's functioning. One of the main problems in managing the energy security of enterprises is the lack of conceptual foundations for the development and functioning of a model for ensuring energy security. Such a model will allow one to prevent threats, use the existing potential and generally support energy security by choosing the optimal energy security strategy.

Thus, the main aim of increasing the efficiency of machine-building enterprises under the conditions of instability and gaining energy independence of the country is to provide energy security by creating a relevant model. Managing energy security through implementing a model for ensuring energy security of enterprises, one can increase the level of energy security due to the use of an optimal strategy. The structural diagram of the model for ensuring energy security of enterprises, developed by the authors of the paper, is aimed at making informed management decisions by top management of enterprises in order to ensure a high level of energy security, which will enable the enterprise to develop energy-efficient technologies, reduce the energy intensity of products in accordance with European standards.

The conducted research showed the priority of formation of strategic vectors for increasing the level of energy security of the enterprise according to the chosen strategy. The suggested ways of evaluation of strategy results for increasing the level of energy security allow to realize the complex of energy-efficient actions at the enterprise and to improve its competitive ability. The availability of thoroughly elaborated energy strategy that comprises the complex plan of its guaranteed actions' realization will help the enterprises to take the energy challenges, to minimize the risks and avoid possible threats, which are connected with energy-supply and energy efficiency consumption.

Further research should be focused on the process of forming a mechanism for ensuring energy security of the enterprise, which involves certain actions: identifying the components of energy security, determining relevant factors of influence on energy security by constructing a hierarchical model of the influence of a set of factors.

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