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## COMPETITIVE ADVANTAGES THROUGH THE IMPLEMENTATION OF INTERNATIONAL ENERGY MANAGEMENT STANDARDS

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**Abstract. Purpose.** The purpose of the presented research is to explore the potential of international energy management standards to increase competitiveness of industrial enterprises under conditions of Ukrainian transitional economy. The study had the following objectives: to trace the evolution of fundamental energy efficiency standards; to discuss experience in their use in various countries; to identify factors that are key to achieving competitive advantage under the implementation ISO 50001. **Methodology.** This article presents a historical overview of the standardisation of principles and approaches for the purpose of the energy-efficient management. The research was carried out by studying the international documents, voluntary standards and national practices in the field of energy efficiency. **Conclusions.** The study examines the experiences of different countries in the field of energy management systems. The authors conducted a comparative analysis of the ISO 50001 with the other basic standards for the organisation of management. The system approach enables to identify the main factors and their impact on capacity to achieve competitive advantages, which are possible to obtain after certification to ISO 50001. **Originality.** The study reviewed and analysed the energy management penetration within its dynamics at time and country level. After analysing the statistical data and the results of the interviews, the authors identified 20 key factors affecting the competitiveness of enterprises that are certified to ISO 50001. All of these factors were divided into four groups, two groups represent external environment – opportunities and threats, and two groups – internal capacity – strengths and weaknesses of enterprises. **Practical value.** The proposed system of factors may be useful for the planning of actions towards strengthening the capacity of energy management systems in the context of the formation competitive advantages on the industrial markets.

**Keywords:** *energy efficiency management; sustainable development; voluntary standards for efficient energy management; energy efficiency indicators related to competitiveness*

## ОТРИМАННЯ КОНКУРЕНТНИХ ПЕРЕВАГ ЗА ДОПОМОГОЮ ВПРОВАДЖЕННЯ МІЖНАРОДНИХ СТАНДАРТІВ УПРАВЛІННЯ ЕНЕРГОЕФЕКТИВНІСТЮ

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**Анотація. Мета.** Метою запропонованого дослідження є вивчення потенціалу міжнародних стандартів з енергетичного менеджменту для підвищення конкурентоспроможності промислових підприємств в умовах української перехідної економіки. Дослідження має наступні завдання: простежити еволюцію основних стандартів енергоефективності; обговорити досвід їх використання в різних країнах; виявити фактори, які є ключовими для досягнення конкурентних переваг в рамках реалізації ISO 50001. **Методика.** Стаття являє собою історичний огляд принципів і підходів до організації систем енергоефективного менеджменту. Дослідження проводилося шляхом вивчення міжнародних документів і національних практик в області досягнення енергоефективності. **Результати.** У дослідженні розглядається досвід різних країн в області систем енергетичного менеджменту. Автори провели порівняльний аналіз ISO 50001: 2011 з іншими базовими стандартами щодо організації менеджменту. Системний підхід дозволив виявити основні фактори та їх вплив на здатність досягти конкурентних переваг, які можливо отримати після сертифікації на ISO 50001. **Наукова новизна.** У дослідженні розглядається і аналізується проникнення енергетичного менеджменту в динаміці у часі та на рівні країн. Після аналізу статистичних даних та результатів опитувань, автори визначили 20 ключових факторів, що впливають на конкурентоспроможність підприємств, сертифікованих на ISO 50001. Всі ці фактори були розділені на чотири групи, дві групи представляють зовнішнє середовище – можливості і загрози, і дві групи – внутрішній потенціал – сильні і слабкі сторони підприємства. **Практична значимість.** Запропонована система факторів може бути корисна для планування дій у напрямку зміцнення потенціалу систем енергетичного менеджменту в контексті формування конкурентних переваг на промислових ринках.

**Ключові слова:** управління енергоефективністю; сталий розвиток; добровільні стандарти управління енергоефективністю; показники енергоефективності для виміру конкурентоспроможності

## ПОЛУЧЕНИЕ КОНКУРЕНТНЫХ ПРЕИМУЩЕСТВ ПОСРЕДСТВОМ ВНЕДРЕНИЯ МЕЖДУНАРОДНЫХ СТАНДАРТОВ УПРАВЛЕНИЯ ЭНЕРГОЭФФЕКТИВНОСТЬЮ

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**Аннотация.** *Цель.* Целью представленного исследования является изучение потенциала международных стандартов по энергетическому менеджменту для повышения конкурентоспособности промышленных предприятий в условиях украинской переходной экономики. Исследование имеет следующие задачи: проследить эволюцию основных стандартов энергоэффективности; обсудить опыт их использования в различных странах; выявить факторы, которые являются ключевыми для достижения конкурентного преимущества в рамках реализации ISO 50001. *Методика.* Статья представляет собой исторический обзор принципов и подходов к организации систем энергоэффективного менеджмента. Исследование проводилось путем изучения международных документов и национальных практик в области достижения энергоэффективности. *Результаты.* В исследовании рассматривается опыт разных стран в области систем энергетического менеджмента. Авторы провели сравнительный анализ ISO 50001: 2011 с другими базовыми стандартами по организации менеджмента. Системный подход позволяет выявить основные факторы и их влияние на способность достигнуть конкурентных преимуществ, которые возможно получить после сертификации на ISO 50001. *Научная новизна.* В исследовании рассматривается и анализируется проникновение энергетического менеджмента в динамике во времени и на страновом уровне. После анализа статистических данных и результатов опросов, авторы определили 20 ключевых факторов, влияющих на конкурентоспособность предприятий, сертифицированных на ISO 50001. Все эти факторы были разделены на четыре группы, две группы представляют внешнюю среду – возможности и угрозы, и две группы – внутренние емкости – сильные и слабые стороны предприятия. *Практическая значимость.* Предложенная система факторов может быть полезна для планирования действий в направлении укрепления потенциала систем энергетического менеджмента в контексте формирования конкурентных преимуществ на промышленных рынках.

**Ключевые слова:** управление энергоэффективностью; устойчивое развитие; добровольные стандарты управления энергоэффективностью; конкурентоспособность; показатели энергоэффективности для измерения конкурентоспособности

**Introduction.** Today, the need to improve energy efficiency of industrial enterprises with an outlook of attracting investments and increasing competitiveness of the industrial sector of Ukraine through the implementation of advanced international practices in this field can be clearly recognised. Energy efficiency management enables enterprises to lower savings in consumer spending, improve the product quality and increase their profitability, while reducing the need for additional investments in development.

However, the ultimate goal of an energy-efficient approach is not only to raise the overall performance levels, but also to achieve significant competitive characteristics that will enhance access to certain markets, to integrate into efficient and inclusive industry value

chains, and ultimately to maintain the sustained economic growth.

For many years Ukraine firmly occupies a leading position in the world ranking of energy intensity of the industrial sector<sup>1</sup>. In 2014, for Ukraine this indicator was 0.27, while for China – 0.18, for United States – 0.09, for Germany – 0.07 [1]. The unit consumption of steel industry<sup>2</sup> in Ukraine is 0.59, while in China this indicator is 0.48, Germany – 0.31, United States – 0.25 [2].

Global energy crisis has created a significant stress in Ukrainian metallurgy, which is the basis of its national economy. Rising energy

<sup>1</sup>The energy intensity of industry is defined as the ratio between the final energy consumption of industry and the value added measured in constant purchasing power parities [3].

<sup>2</sup>The unit consumption of steel industry is calculated as the ratio between the final energy consumption of steel industry and steel output measured in tons [3].

costs and conditions of an ongoing energy deficit accelerated the requirements to reform the production policy in support of the progressive principles of energy management.

The sustainable and responsible development of the production companies must be carried out in an adequate framework, where energy efficiency and safety are essential elements. At the same time, such framework must provide the necessary guarantees to all stakeholders that the company is committed to complying with the high standards of energy efficiently and contributes to this requirement's implementation along the entire production chain.

Taking into account these considerations, the international scientific community offers universal voluntary energy efficiency standards, which were designed to ensure building systemic capacity for industrial energy efficiency as tool to promote sustainable production, markets and market relations.

For the Ukrainian enterprises obtaining competitive advantages through the application of energy efficiency standards is still a new phenomenon, so the potential for reducing energy consumption by the industry in Ukraine remains enormous.

It is worthwhile to note that scientific debates on energy management in the industrial sector have recently increased. Ukrainian scientists investigate the role of energy management and government control of energy-savings in industry (e.g. Y. O. Kostenok [3]), the need for energy efficiency and problems of implementation of energy management system (e.g. K. O. Bratkovska [4]), approaches for the improvement of energy efficiency (e.g. N. V. Parhomenko and O. A. Polozova, [5]), and others.

In context of this research, of particular interest are the last monographic publications in this field, including those on the fundamental principles and systematic processes of maintaining and improving energy efficiency by Craig B. Smith & Kelly E. Parmenter [6], energy efficiency management for the process industries by Alan P. Rossiter & Beth P. Jones [7], interdisciplinary approach to the various barriers with energy efficiency by Patrik Thollander & Jenny Palm [8]. Nonetheless,

the capacity of voluntary energy efficiency standards for the formation of competitive advantages in the industrial markets remain relatively uncharted.

**Purpose.** The purpose of the presented research is to explore the potential of international energy management standards to increase competitiveness of industrial enterprises under conditions of Ukrainian transitional economy. The study had the following objectives: to trace the evolution of fundamental energy efficiency standards; to discuss experience in their use in various countries; to inquire the problem of implementing the ISO 50001 standard in Ukraine; to analyse functions of voluntary energy efficiency standards in the context of formation of competitive advantages.

**Methodology.** This article presents a historical overview of the standardisation of principles and approaches for the purpose of the energy-efficient management organisation. The research was carried out by studying the international documents, voluntary standards national practices in the field of energy efficiency. The system approach enables to analyse the properties and functions of voluntary energy efficiency standards and to identify their capacity to achieve competitive advantages by Ukrainian industrialists.

**Findings.** Progress in achieving industrial energy efficiency is one of the most important components of the sustainable development concept, which is directly aimed at realisation of its objectives – a balanced economic growth and social development based on inexhaustible and equitable use of primary natural resources. This approach became the basis for the EU development strategy, which includes not only reduction in global energy intensity but the transition to clean energy and green economy, formation of a new type of markets and value chains, based on the support of energy-efficient tools and techniques.

In Ukraine since independence until recent years the energy sector remained the most vulnerable and the most disturbing element in the pursuit of competitive economy. The fundamental challenges for industrialists are how to decouple the consumption of energy resources from economic growth. In this regard, energy

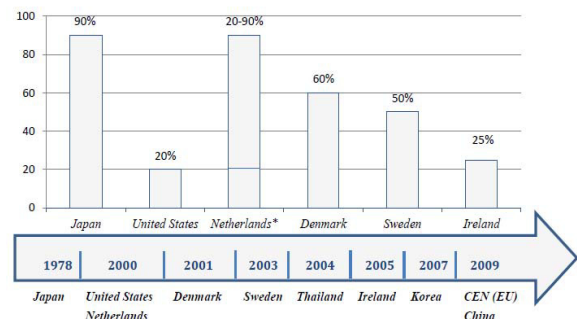
efficiency programmes for enterprises and regions are primarily concentrated on achieving energy saving – reducing or even partially operating without an energy service to save energy<sup>3</sup>. Thus, ‘energy efficiency gain’ is defined as providing the same level of production while reducing the use of energy, or obtaining higher economic benefits from the same energy input [6-8].

At the same time it is important to understand that the objectives of energy efficiency and sustainable development are closely linked. In this regard, the World Energy Council (WEC) framed the energy efficiency concept as the Energy Trilemma, which involves three objectives of a balanced (sustainable) development: energy security, energy equity and environmental sustainability [10]. Such interpretation is steadily gaining weight in international initiatives for energy efficiency management, of which the energy efficiency standards can be highlighted. Today’s energy standards may be designed as industry standards (for specific industries)<sup>4</sup> or universal /cross-sectoral standards (for all industries)<sup>5</sup>; both types of energy standards can come in two formats: required (mandatory) and recommended (voluntary) standards.

It should be noted that voluntary application of international standards, such as ISOs and sector specific voluntary standards, is a new phenomenon for post-Soviet states linked to a transition economy. As part of measures on joining the EU space, Ukraine implemented reforms to reduce the abundance of technical regulations in production, management and trade through harmonisation of certification procedures with provisions of EU Directives [14]. Moreover, starting with January 2016 the

technical standards in Ukraine cease to exist as mandatory (i.e. compulsory) standards – the private sector / business will start implementing western standards [15]. Under these conditions it is important to understand the peculiarities of voluntary standards of energy management and the benefits for industrial enterprises.

Studying the best world practices on the enhancement of energy management showed that countries had different approaches to understanding and solving the problem of energy efficiency. For example, Japan has the Energy Conservation Act (1978), which includes multi-sectoral requirements for energy efficiency. Energy management was introduced in the Netherlands within the Voluntary Agreement (VA) programme, not a standard; the programme was established in the late 80’s of the previous century as a policy instrument to increase energy efficiency in Netherlands’ industry. In some countries, the introduction of ISO 50001 is mandatory for large companies (e.g. in Thailand). The penetration rate of energy management in industrial sector is also very different (see Fig. 1).



\*Companies representing 20% of energy use have LTAs and must use the Energy Management System. The most energy intensive companies, representing 70% of the energy use, have a separate, more stringent, benchmarking covenant and are typically ISO 14000 certified, but are not required to use the EM System.

Fig. 1. The dynamics of penetration of the energy systems in time and country (Source: [16] as updated by the authors)

Almost all the national standards rests upon several identical fundamentals – in particular, the concept of continuous improvement (Plan-Do-Check-Act Cycle), the existence of energy baseline date, the procedure for developing energy efficiency indicators, etc.

Today, the leading role in the development of international standards belongs to the International energy agency (IEA) and International

<sup>3</sup>For example, in Ukraine the project of the German Society for International Cooperation (GIZ) “Energy efficiency in municipalities” focuses mainly on the implementation of energy-saving technologies in the housing and communal services to reduce total energy consumption in municipalities [9].

<sup>4</sup>For example, the Electric Efficiency Institute (Washington, USA) has developed the integrated codes and standards for energy efficiency management in electric power sphere (2011) [11]. The International Energy Agency (IEA) proposed requirements for certain building codes relating to the new construction (2009) [12].

<sup>5</sup>These include ISO standards – documents that provide requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose [13].

Organization for Standardization (ISO). At the G-8 meeting in 2008 these organisations submitted a joint Memorandum ISO/IEA to develop ISO 50001:2011 Standard, Energy management systems – Requirements with guidance for use. The new basic standard is intended for creating and certification of energy management systems (EnMS). The ISO 50001:2011 standard has taken into account the experience of the U.S. standard ANSI/MSE 2000:2005, Korean standard KS A 4000:2007, and other national standards on energy management (see Table 1).

Table 1

**National standards for energy management\***

Country	Reference	Title of the standard
USA	ANSI/MSE 2000:2008	Management System for Energy
Denmark	DS 2403:2001	Energy Management – Specification
Sweden	SS 627750:2003	
Ireland	IS 393:2005	Energy Management Systems – Specification with Guidance for Use
Spain	UNE 216301:2007	Energy Management System – Requirements
EU	EN 16001:2009	Energy Management Systems
France	BPX30-120:2006	Le Pré diagnostic énergétique dans l'industrie (engl. Diagnosis of energy consumption in the industry)
Spain	UNE 216501:2009	Auditorías energéticas. Requisitos (engl. Energy audits. Requirements)
Italy	UNI CEI 11339	Gestione dell'energia - Esperti in gestione dell'energia - Requisiti generali per la qualificazione (engl. Requirements for experts in the field of energy management)
South Korea	KS A 4000:2007	Energy Management System
China	GB/T 23331:2009	Management System for Energy – Requirements
South Africa	SANS 879:2009	Energy Management – Specifications

\*Source: compiled by the authors according to [16-17]

It must be stressed that focus on the implementation of the energy management systems has significantly increased after the publication of European energy management standard – EN 16001 in July 2009. In accordance with the rules of the European Union standardisation, the standard was to be adopted as national standards in the EU member states.

Specifications of EN 16001:2009 and ISO 50001:2011 are very similar because both are formed on the basis of the widely used ISO 14001 standard. This not only facilitates the

implementation of new basic standard, but determines its high compatibility with the programs of quality management (ISO 9001-2000), environmental management (ISO 14001), occupational health and safety management (OHSAS 18001), and allows you to organise an integrated management system of the enterprise. It is very important that the introduction of ISO 50001 has eliminated the inconsistency in relevant national standards and unified energy management in different countries [17].

The adoption of Energy Efficiency Directive 2012/27/EU greatly encouraged the certification of large enterprises in the EU. To reach the EU's 20% energy efficiency target by 2020, Directive requires energy audits should be mandatory and regular for large enterprises [18]. This energy audits can be applied through energy audit itself (EN 16247-1), energy management systems (EN ISO 50001) or undertaken in accordance with EMAS, because EMAS-certified companies often already meet all the requirements of an energy management system. Nevertheless, certification according to ISO 50001 by global region is very uneven. (see Fig. 2).

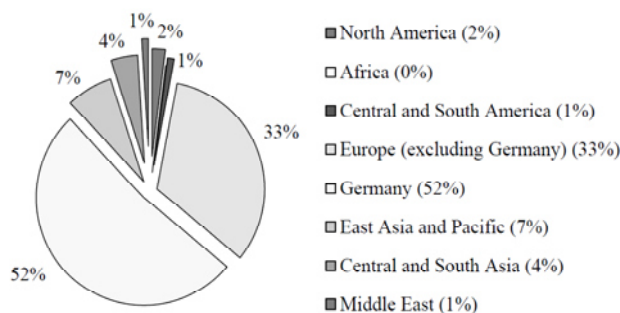


Fig. 2. Global distribution of certification according to ISO 50001 by region (%) as of January 2014 (Source: compiled by the authors according to [16-17])

Today, the leader in certification to ISO 50001 is Germany that occupies 52% of the market. That could be explained partially by the focus of national legislation on the issue of sustainable development and energy efficiency, as well as a higher awareness and recognition of the part that strong energy management plays in corporate social responsibility (CSR).

It shall be reminded that in Ukraine the certification to ISO 50001 is only just begin-

ning to develop. In this direction, the Ministry of Economic Development and Trade approved the National Standard DSTU ISO 50001:2014 “Energy Saving. Energy Management Systems: Requirements and Application Guidelines (ISO 50001:2011, IDT)”, which entered into force in January 2015. At the same time, many industrial companies have already gone on a way of certification on compliance with ISO 50001 (e.g. JSC Ingulets Ore Mining and Processing Plant, PJSC Energomashspetsstal, JSC Zaporizhstal, etc.). The study of the experience made it possible to highlight the preconditions for the expansion of the process, as well as the motivations, difficulties faced and the intended benefits of introducing an EnMS standard.

Economic theory and the best international practices have already proved that voluntary certification of the energy management systems is a tool of market activity. For the purpose of gaining in-depth knowledge about the factors that promote or inhibit the increase in the competitiveness of certified companies, we have interviewed 10 managers of 4 industrial enterprises. Interviews were conducted with the use of laddering method<sup>6</sup>, including ten open questions. Respondents also had to identify the main factors of success and failure, to assess the strength of their impact and probability of occurrence.

Factors were selected by the assessing the efforts and achievements. The identified factors were divided into four groups, two groups represent external environment – opportunities and threats, and two groups – internal capacity – strengths and weaknesses of enterprises. Twenty of the most significant factors (five factors in each group) are represented in table 2.

We shall dwell on some of these factors. The analysis confirmed that in Ukraine the necessary political and legal environment is being formed. Firstly, under the Action Plan for Implementation of Ukraine-EU Association Agreement and the Ukraine’s joining to the Energy Community Treaty, the Government carries out the harmonisation of domestic legal

framework for energy to the *acquis communautaire*. These actions are supported by a program for implementation of EU Directives in the field, and the road map for compliance with the EU energy efficiency legislation [19].

Sustainable energy value chains perceive the high value for Ukrainian enterprises. However, all managers have noted as a strong threat the lack of measures to enhance energy management.

In this regard, the German market oriented approach is characterised by a variety of instruments and measures at federal, land and municipal level. Germany has the biggest and sophisticated markets of energy services – energy consulting and contracting; a huge variety of services is offered by a plenitude of stakeholders that differ significantly in size and specification and that actively compete with each other. Contracting is one of the most important energy services, its market turnover is estimated well over 2 Billion Euro per year [20].

By implementing the ISO 50001 management system, companies can achieve significant energy savings and gain a real competitive advantage [21].

Also, the strength of the Ukrainian industrialists is certainly the experience in basic standards of management DSTU ISO 9001, DSTU ISO 14001, DSTU OHSAS 18001. As of today, around two thousand certificates for quality management system and environmental management system operate in Ukraine. Such enterprises have already been creating the integrated system of corporate management [13]. Among the factors, that are important drivers for Ukrainian enterprises certified to ISO 50001, can be noted the increase of investment attractiveness due to the reduction of energy and environmental risks with energy supply, consumption limitations and other problems.

Another problem is poor Ukrainian public knowledge and awareness of energy management practices and successful experiences both in Ukraine and in other countries. In this regard it is important to take into account that objectives of energy efficiency and sustainable development cannot be achieved only by the efforts of individual companies, and even coun-

<sup>6</sup>The laddering method of interviewing is a technique that is particularly helpful in eliciting underlying values and goals, and therefore is useful for capturing qualitative research data with a small stock of empirical experience and a small sample.

tries or regions. The experience on energy efficiency should be available and distributed easily both in countries with advanced economies and in developing countries.

*Table 2*  
**Factors of influence on the competitive advantages in the implementation of ISO 50001 management\***

№	Factors	Rating (-5 to +5)		
		Value	Chance	Overall Rating
<b>External factors</b>				
<b>Opportunities</b>				
1	Prospect for Ukraine-EU Association Agreement and the Ukraine's joining to the Energy Community Treaty	4	4	16
2	Initiatives to establish energy value chains	5	3	15
3	Market development of energy saving technologies	3	3	9
4	Establishing an energy audit scheme and energy baseline date for industries	2	4	8
5	Programs of bank loans on preferential terms	1	3	3
<b>In total</b>				51
<b>Threats</b>				
6	The lack of government measures to stimulate the implementation of ISO 50001	-5	5	-25
7	Lack of information and exchange of experience	-4	5	-20
8	Lack of quality audit of the internal market	-3	2	-6
9	The lack of tax incentives for businesses that are certified	-2	1	-2
10	The absence of labelling practice of energy efficient products	-1	1	-1
<b>In total</b>				-54
<b>Internal factors</b>				
<b>Strengths</b>				
11	Reduction of energy consumption and the level of costs	5	4	20
12	Experience of basic management standards (DSTU ISO 9001, DSTU ISO 14001, etc.)	4	5	20
13	Increasing investment attractiveness	3	2	6
14	Improving the environmental performance	2	2	4
15	Improving the image and prestige of the company	1	2	2
<b>In total</b>				52
<b>Weaknesses</b>				
16	Senior managers do not really know the principles of energy management	-5	4	-20
17	The worn out equipment and low technology	-4	5	-20
18	Insufficient level of basic staff training	-3	2	-6
19	No integrated development programs	-2	3	-6
20	The absence of internal incentives	-1	1	1
<b>In total</b>				-53

\*Source: compiled by the authors

To overcome these barriers the universities should assume the mission of guides of new ideas and achievements in this area. It is remarkable that such a position was manifested

by of participating universities in the International Workshop “Energy supply and energy saving” (Baku, 21-27 September 2015), which discussed the problems of energy efficiency in Germany, Russia, Ukraine and Azerbaijan. At this forum, the universities have established the Neseff – the international network of universities for energy supply and energy efficiency.

**Originality and Practical value.** The study reviewed and analysed the energy management penetration within its dynamics at time and country level. After analysing the statistical data and the results of the interviews, the authors identified 20 key factors affecting the competitiveness of enterprises that are certified to ISO 50001: 2011. All of these factors were divided into four groups, two groups represent external environment – opportunities and threats, and two groups – internal capacity – strengths and weaknesses of enterprises.

The proposed system of factors may be useful for the planning of actions towards strengthening the capacity of energy management systems in the context of the formation competitive advantages on the industrial markets.

### Conclusions

1. It is important to understand that the objectives of energy efficiency and sustainable development are closely linked. In this regard, the energy efficiency concept as the Energy Trilemma involves the following objectives: energy security, energy equity and environmental sustainability.

2. The best international practices confirmed that voluntary certification of the energy management systems is a tool of market activity.

3. The main factors of success or failure to achieving competitiveness can be divided into four groups, two groups represent external environment – opportunities and threats, and two groups – internal capacity – strengths and weaknesses of enterprises.

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