

**Macroeconomics**

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**ENERGY EFFICIENCY
IN MODERN UKRAINIAN ECONOMIC POLICY**

Abstract

This article investigates the problem of the energy efficiency within the context of the global economic, environmental and social challenges of the XXIst. The criteria of functioning of the modern energy market is defined, where the energy efficiency is ranged as its fundamental basis. The global trends in the implementation of the energy-saving technologies and the economic factors of the energy efficiency are considered. The energy consumption in the various sectors of Ukrainian economy is analyzed on the international comparative basis. The strategic priorities of the national policy of energy efficiency are outlined, the energy saving potential due to the introduction of the targeted technical and structural measures is assessed. The consolidated examples of the energy policies of the other countries, focused on the development of alternative energy sources are presented for their selective use in the domestic practice.

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Key words:

World energy market, hydrocarbon-based economy, alternative energy, energy consumption, energy saving, national energy policy, energy efficiency.

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Formulation of the problem. The problem of energy efficiency is one of the basic problems in providing the stable and safe development of the economy of Ukraine. Economically and in a technical sense, this problem has been studied, at the microlevel, macrolevel, mesalevel, and matalevel, by many foreign and domestic scientists, such as A. Albert, V. Geiz., V. Dannikov, R. Griffin, T. Oriekhova, T. Mort, O. Shvydkyi, and others. The comprehensive characterization of energy utilization in various sectors of economic activity, assessment of the state of the fuel and energy industry of Ukraine, monitoring of energy efficiency indicators, and analysis of potentialities as well as restrictions on effectuating the potentialities for enhancing energy efficiency in the regions of Ukraine are examined in the fundamental paper of B. Stohnii, O. Kyrylenko, A. Prakhovnyk, S. Denysiuk, and Z. Butso from the National Academy of Science of Ukraine and the Kyiv National Technical University [3]. The energy efficiency of economy from the viewpoint of management has been studied by O. Shvydkyi [7]. The energy policy of Ukraine [2], updated in 2012, specifies the necessity to concentrate to 2030 largely on energy efficiency, competitiveness, and transparency in the energy market, and to give attention to the safety of the energy industry and consequences of energy consumption for the ecology [2]. With consideration for these objectives, the problem of energy efficiency is discussed in the review of the energy policy of Ukraine initiated by the International Energy Agency. This review contains the results of the analysis of the current energy policy of Ukraine and recommendations for the further improvement of this policy.

However, in the economic science, the number of papers of domestic scientists relating to problems in the development of the energy and oil-and-gas industries, specifically to the problems associated with the optimal arrangement of the national energy market and sectorial and corporate management, is insufficient.

To our opinion, the modern methods for studying energy efficiency problems in the development of the economy of Ukraine should be based on the results of complex analysis of conditions required for handling the problems, efficiency and quality of energy supply and consumption in Ukraine, sectorial potentialities of energy saving, and external and internal factors affecting the formation of the national policy with respect to energy efficiency.

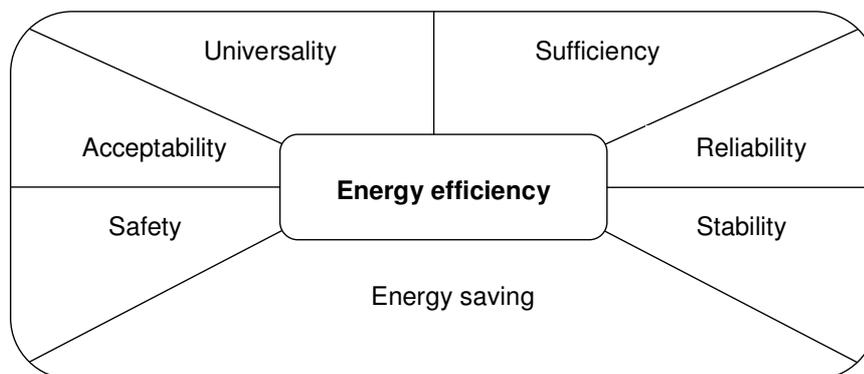
The aim of the article. To generalize the international experience in energy-efficient development of economy and to determine the methods for implementing this experience in the economic and energy strategies of Ukraine.

The basic material. Analysis of energy efficiency. Energy efficiency, if considered in terms of modern technical indicators, has a significant effect on economic development. For example, the International Energy Agency predicts that to 2035 the world consumption of oil will increase from current 89 million barrels to 100 ... 110 million barrels per day. That is, in spite of scientific evidences that the long-term consequences of economy based on hydrocarbon fuels will be very unfavorable, such economy will be developing further and be more dependent on fossil fuels. The economic model accepted in Ukraine is based on consumption of traditional hydrocarbon fuels, such as coal, oil, and gas.

With consideration for ecologic and economic factors, energy efficiency becomes not only more and more important criterion but also the systemic criterion that has an effect on the functioning and further development of the energy market (see Figure 1).

Figure 1

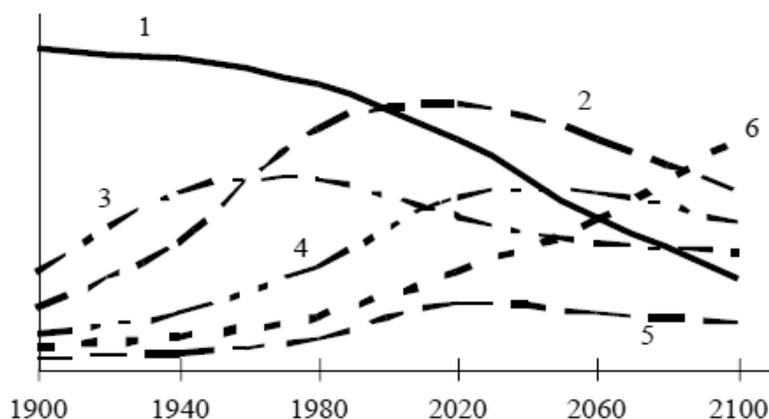
Criteria specific for the modern energy market



These conclusions are confirmed by the predictions of development of the world economy in the conditions of intensive globalization in relation to the further use of natural energy resources, environment pollution, and rate of implementation of energy-saving technologies (see Figure 2).

Figure 2

**Predictions of development of the world economy
in the conditions of intensive globalization [10]**



1 – natural energy resources; 2 – population; 3 – quality of life; 4 – investments; 5 – environment pollution; 6 – implementation of energy-saving technologies in the national economy.

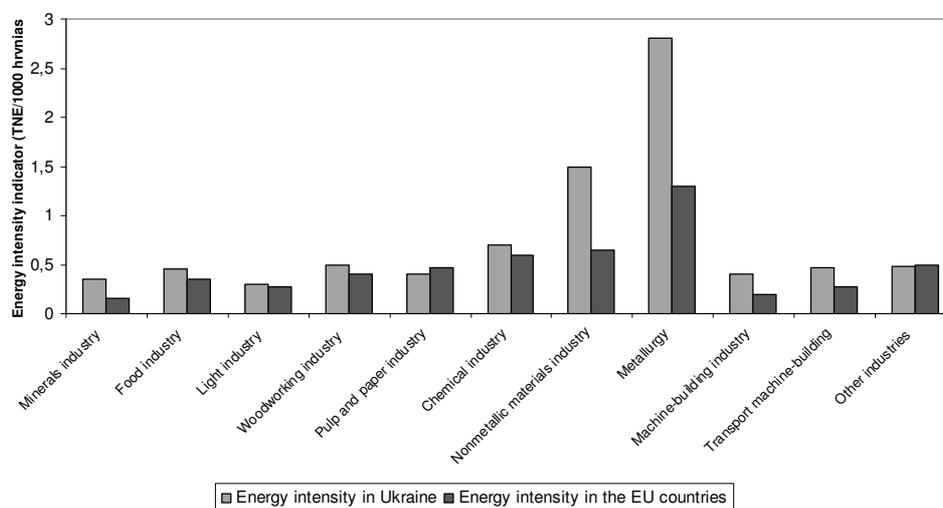
With respect to economic measures, recommendations of experts for improving energy efficiency are directed to providing the availability, reliability, and authenticity of statistical data about energy efficiency indicators, strengthening organizational and management activities in connection with energy efficiency, establishing monitoring procedures, and developing programs for government financing and stimulation of investments required for improving energy efficiency [2].

Scientists and experts have determined a number of problems that are considered as critical for ensuring the energy-independent and energy-efficient economy of Ukraine. Firstly, Ukraine depends, to a great extent, on prices for imported natural gas and oil. For example, the percentage of imported gas in the total structure of imports has been more than 40 percent. Accordingly, Ukraine is

subjected to external stresses caused by increase of prices for natural gas and oil, which become less and less predicted and require high competence for monitoring and taking countermeasures [1]. Secondly, the economy of Ukraine is the most energy intensive economy in Europe (see Figure 3), with the average energy intensity indicator exceeding about 10 times the average energy intensity indicator determined for the member states of the Organization for Economic Cooperation and Development, and 3.2 times the same indicator calculated with consideration for the purchasing power of population [7].

Figure 3

Energy intensity of industry branches in Ukraine and the EU countries [8]



The high energy intensity of industry and household in Ukraine is caused by the wasteful consumption of fuel and energy resources due to the significant technological gap between the industry of Ukraine and that of the EU countries, high level of fixed assets depreciation (about 70 percent), disagreement of rates for products and services, which are provided by enterprises of the fuel-and-energy complex to the population of Ukraine, with economically sound rates, slow implementation of projects relating to restorable energy resources, and general regress of the energy industry of Ukraine. The impact of these factors is aggravated due to the excessive physical depreciation of basic production assets

and the low technological level of energy production and consumption, absence of effective vertically-integrated national corporate structures, insufficient profitability of the national oil-and-gas companies, and domination of importers and intermediaries in the energy market without transparent guidelines established by law with respect to competitiveness.

At the present time, the higher-priority tasks of the energy-effective policy in Ukraine are the following: the development of own production of oil and gas on a new technological base, modernization of the transport infrastructure, substitution of gas fuel with nuclear power and coal, geographic diversification of energy carrier sources, renovation of the economy structure, reduction of energy-intensive enterprises, and formation of the proper attitude of the society and corporate management to energy saving.

Very important for implementing the national policy with respect to energy efficiency is to improve management activities in the energy industry. For this purpose, it is required to provide reasonable administrative procedures, transparent use of budgetary funds, effective competition, just resolution of conflicts, and effective measures against corrupt practices. The achievement of these objectives will be promoted by the joining of Ukraine to the European initiatives with respect to the transparency of activities of monopolistic energy-producing companies.

The general potentiality of energy saving has been assessed with consideration for taking technological measures (such as increasing the efficiency of production, transportation, and consumption of energy resources and, correspondingly, decreasing energy intensity of products and services due to the implementation of new energy-efficient technologies and energy-saving processes) and introducing structural changes (such as changing macroeconomic indicators in order to reduce energy consumption and decrease the percentage of energy-intensive enterprises in the industry and transport by promoting development of knowledge-based production processes with low energy intensity and specific consumption of materials). See Table 1.

At the present time, there are opportunities for the development of restorable energy sources. According to the data of the Institute for Restorable Energy Industry of the National Academy of Sciences of Ukraine, the restorable energy sources in Ukraine can produce about 600 billion of kW·h or 100 million of equivalent fuel tons per year. However, for achieving success in this branch of the national energy industry, it is required to introduce new technologies and provide active state policy for promoting new technologies, such as the policy that has been effective in the majority of countries of the world since 2000. See Table 2.

Table 1

General potentiality of energy saving [2]

Energy saving (millions of equivalent fuel tons)	2010	2015	2020	2030
Due to technological measures	66.36	109.81	137.47	198.06
Due to structural changes	7.94	25.30	54.37	120.30
Total:	74.30	135.11	191.84	318.36
Including Fuel (millions of equivalent fuel tons)				
Due to technological measures	42.85	71.28	95.38	128.42
Due to structural changes	6.08	20.00	45.31	102.88
Total:	48.93	91.28	140.69	231.30
Electric power (billions of kW·h/millions of equivalent fuel tons)				
Due to technological measures	44.37/15.75	70.99/24.84	72.45/24.63	108.72/35.88
Due to structural changes	2.65/0.94	7.88/2.76	13.79/4.69	27.90/9.21
Total:	47.02/16.69	78.87/27.6	86.24/29.32	136.62/45.08
Thermal energy (millions of Gcal/ millions of equivalent fuel tons)				
Due to technological measures	48.28/7.76	86.24/13.69	112.62/17.46	231.87/33.76
Due to structural changes	5.71/0.92	16.00/2.54	28.18/4.37	56.41/8.21
Total:	53.99/8.68	102.24/16.23	140.80/21.82	288.28/41.97
Capital investment (billions of hryvnias)				
Due to technological measures	30.6	53.7	69.0	102.3
Due to structural changes	-	-	-	-
Total:	30.6	53.7	69.0	102.3

Table 2

Examples of energy policy accepted in countries of the world with respect to the support and development of restorable energy sources [11]

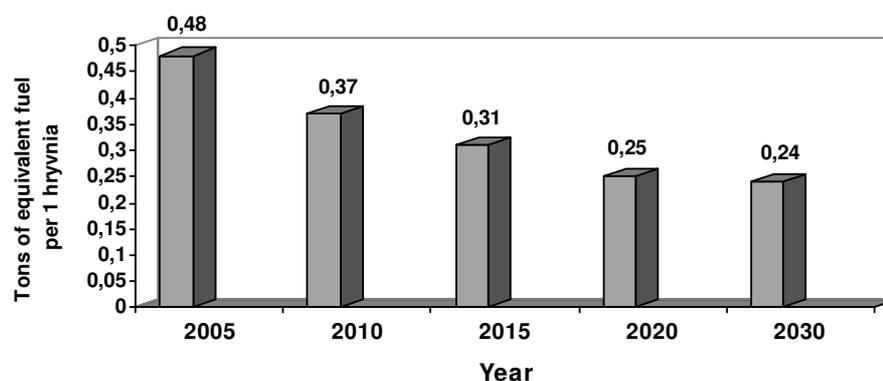
Country	Year	Policy feature	Policy means
Belgium	2001	Since January 1, 2002, all energy suppliers had to purchase restorable energy certificates, in the specified number, from energy producing companies (up to 6 % in 2010)	Trade certificates
Germany	2004	Fixed tariffs were introduced for commercial companies that use energy from restorable energy sources	Introduction of tariffs
Germany	2005	The fifth R&D program for the development of the energy industry established the system for supporting public R&D activities for the development of alternative energy industry	Subsidies for performing R&D works
Austria	2006	According to the legislative act «On Restorable Energy Sources» of 2006, investments grants for new alternative power plants were provided	Investment grants
Denmark	2001	New regulations for payments for environmentally safe energy (fixed prices per 1 kW of electric power produced by wind power plants) were introduced	Introduction of tariffs
Japan	2002	For energy suppliers, annual obligations were introduced to use the specified amount of electric power, produced by alternative power sources, by providing own power production, purchasing power from power producing companies, or purchasing special certificates	Obligations and trade certificates
Canada	2006	Subsidies and grants were provided to the amount of 33 percent of the cost of the project «Stable Technological Development of Canada»	Subsidies for performing R&D works and investment grants
USA	2004	Tax deductions were provided for the financing of projects in connection with the development of restorable energy sources	Tax deductions for investments
Italy	2000	Consumers of thermal power produced by central heating systems from geothermal sources or biomass could obtain tax credits	Tax credits for consumers

Country	Year	Policy feature	Policy means
UK	2002	Electric power suppliers were obliged to supply a specified percentage of electric power from alternative power sources. (7.9 percent in 2007 and 2008)	Obligations
The Netherlands	2003	According to the document «Requirements for the Ecological Quality of Produced Electric Power», subsidies should be granted only to those internal power-producing companies that produce power from alternative power sources	Production subsidies
Poland	2000	Energy distributing companies were obliged to supply a specified part of energy from alternative energy sources	Obligations

Generally, due to the realization of potentialities for energy saving, the energy intensity of the Gross Domestic Product of Ukraine in 2030 may be decreased to 0.24 kg of equivalent fuel per 1 hryvnia, that is, may be two times less than the current energy intensity of 0.48 kg of equivalent fuel per 1 hryvnia (see Figure 4).

Figure 4

Predicted energy intensity of the Gross Domestic Product of Ukraine [2]



Generally, it is necessary to develop, on the base of the results of the integrated assessment of energy efficiency, a plan of actions, agreed upon between the branches of the national energy industry, which can be implemented in special government and private, primarily international, programs and projects.

The effectiveness of such programs and projects should be assessed with consideration for the current problems of economy of Ukraine and the compliance of the national economic model with the criteria of stable economic development.

Conclusions. For the development of the world energy market in the conditions with the dominant hydrocarbons-based economy and the global energy crisis, it is necessary to concentrate research activities and practical measures on providing energy efficiency. Most countries of the world make political decisions and adopt corresponding programs for improving energy efficiency in order to change to an economy not based exclusively on hydrocarbon fuels. This change will cause the qualitative transformation of the world energy balance.

The low level of own oil and gas production, significant energy intensity of Ukrainian enterprises, critical dependence of supply of hydrocarbon energy carriers on external suppliers, price distortions in payments for energy consumption, and the expansion of foreign transnational companies in the national energy market in the conditions when the national oil-and-gas companies are noncompetitive cause the problem of energy efficiency to be actual for Ukraine. This problem is aggravated by the effects of geopolitics.

Together with the increase of own production of natural gas, diversification of energy sources, optimization of the transport infrastructure in order to more efficiently use the transit transport potentialities, and implementation of restorable energy sources, the national policy of Ukraine with respect to energy efficiency will provide demonopolization, transparency, and predictability of the energy market activities in order to create conditions for the rational use of energy resources.

In order to implement the national policy with respect to energy efficiency it is necessary to improve management in the energy industry by providing reasonable administrative procedures, transparent use of budgetary funds, effective competition, just resolution of conflicts, and effective measures against corrupt practices. It is also important to provide energy saving by using organizational measures, for which significant financial expenditures are not required, 100-percent audit of energy resources, calculations of net energy consumption instead of calculations of mass or volume consumption, optimization of energy use modes at industrial enterprises, and other measures.

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