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### **PROBLEMS AND PROSPECTS OF UKRAINE'S ENERGY SUPPLY IN THE ASPECTS OF INTERNATIONAL TRADE**

**The article studies the energy efficiency of the economy and determines the need to reform the energy sector of Ukraine and conditions of its adaptation to EU requirements.**

**Annual energy consumption in the world is about 14 billion tons of fuel. This is mainly organic origin resources – coal, oil, natural gas – 82 %, nuclear power – 7 %, hydroelectric energy – 3%, wood – 7 % renewable energy and – 1 %. The economic development of any country in our time is determined not only by the number of extracted or consumed fuel and energy resources (FER), but the efficiency of their use – energy intensity of GDP, unit costs per unit of output. These figures are better in those countries which have established effective economic and legal mechanisms to encourage energy efficiency, which in turn stimulated the development of energy-saving technologies, equipment supply and services for energy efficiency.**

**Analysis of international experience shows that Ukraine's energy dependence can be reduced by: increasing production and consumption of domestic energy resources; increasing the efficiency of production, transportation and consumption of energy resources; diversification of energy imports and types of energy consumed.**

**The study emphasizes that «energy is an important prerequisite for growth and development throughout the world, and despite the global financial crisis, demand for energy is growing steadily, particularly in the large economies of China, India and Brazil, developing countries.**

**The authors prove that energy security is largely complicated by the fact that key energy resources are concentrated geopolitically. Most of the world's oil and gas are found in several countries, some of which «are in a state of political turmoil and are not particularly friendly to US interests»(Gray F, 2010).**

**The conclusions can be summarized that in the context of the main areas of research reducing risks to energy security of Ukraine are: energy efficiency economy (reduce unit cost of energy per unit of GDP); increase proved reserves and production of domestic energy resources; the transition from the use of expensive imported energy resources (oil, natural gas) to other fuels, especially domestic origin; opposition to fluctuations in energy prices (particularly by combating monopolization of the energy market, development of market infrastructure provisioning energy, preservation of state fuel and energy complex and the situation in the energy market); the development of the market principles of the electricity industry, promoting competition in this area.**

**Key words:** fuel and energy complex, energy markets, energy resources, gas markets, energy efficiency, renewable energy sources, energy supply diversification.

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## **ПРОБЛЕМИ І ПЕРСПЕКТИВИ ЕНЕРГОЗАБЕЗПЕЧЕННЯ УКРАЇНИ В АСПЕКТІ МІЖНАРОДНОЇ ТОРГІВЛІ**

Дана оцінка енергоефективності економіки та встановлена необхідність реформування енергетичного сектора України та умов його адаптації до вимог ЄС. Аналіз міжнародного досвіду показує, що енергетична залежність України може бути зменшена шляхом: збільшення виробництва і споживання внутрішніх енергоресурсів; підвищення ефективності виробництва, транспортування та споживання енергоресурсів; диверсифікації імпорту та видів споживаної енергії.

*Ключові слова:* паливно-енергетичний комплекс, енергетичні ринки, енергетичні ресурси, ринки газу, енергоефективність, відновлювані джерела енергії, диверсифікація поставок енергії.

**А. А. Редченков, Н. А. Красникова**

## **ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ ЭНЕРГООБЕСПЕЧЕНИЯ УКРАИНЫ В АСПЕКТЕ МЕЖДУНАРОДНОЙ ТОРГОВКИ**

Дана оценка энергоэффективности экономики и определена необходимость реформирования энергетического сектора Украины и условий его адаптации к требованиям ЕС. Анализ международного опыта показывает, что энергетическая зависимость Украины может быть уменьшена путем: увеличения производства и потребления внутренних энергоресурсов; повышения эффективности производства, транспортировки и потребления энергоресурсов.

*Ключевые слова:* топливно-энергетический комплекс, энергетические рынки, энергетические ресурсы, рынки газа, энергоэффективность, возобновляемые источники энергии, диверсификация поставок энергии.

### **Introduction**

A characteristic feature of the world economy in recent years has been an increased competition for non-renewable resources, which is the evidence of increased tensions and increasing conflicts in areas of significant energy deposits. It is therefore extremely important to timely detect the regional problems in ensuring energy security in order to develop recommendations for their resolution or at least significant reduction of their severity.

Energy resources are the most important for the development of the world economy. Providing economies with energy resources is a global problem, whose solution requires an integrated approach and coordinated action by the entire international community.

Despite of the slowdown (and in some cases even stagnation) of economic growth in developed market economies in the late first – early second decade of the XXI century, world energy demand continues to grow (British Petroleum, 2009). In 2000-2016 annual growth of primary energy consumption amounted to 2,4 %, while in the countries of the Organization for Economic Cooperation and Development (OECD), it was less than 1 %, and the remaining increase came in developing countries (Kader, 2013).

In this regard, there is scientific and practical interest in analysis of the situation and prospects of international gas markets development, including the markets of liquefied natural gas and shale gas, as well as the role and place of Ukraine as one of the main exporters of energy

and prospects for cooperation in the gas sphere between Ukraine and other countries.

Whereas intensification of the process of building a single energy market in recent decades, ensuring security of supply of energy is a key element of energy policy. At the same time, there are a number of contradictions between such landmarks as the markets opening and liberalization, on the one hand, and stability of supply on the other.

***Analysis  
of recent  
researches  
and  
publications***

The study of world markets and international trade highlighted in the scientific work of outstanding classical economic thought: R. Vernon, Charles Kindelberhera, P. Krugman, Leontief, John. Mill, B. Olin, David Ricardo, Adam Smith, L. Wales E. Heckscher and others.

Significant contribution to the study of the problems of development and functioning of world markets, particularly considering the impact of the economic crisis, has been made by such Ukrainian scientists as D. Lukyanenko, Yuri Makogon A. Rogach, Alexander Rummyantsev, I. Taranenko A. Shnyrkov etc. The issue of energy markets has been researched by the leading domestic and foreign scientists such as Alexander Amosha V. Bushuev, P. James F. Parr, W. Pride, R. Ryan, R. Seydl, P. Horsnell. All this shows the importance of the subject of this study.

Although the question of energy security has been studied for a long time, there is a need in interpretation of current conditions in energy market of Ukraine.

The goal of this scientific research and methods. Aim of the study is the energy security of the state and its existence in international trade aspect. The study examined the features of formation and functioning of the energy market of Ukraine.

The purpose of the study – to develop recommendations to improve and increase energy independence of Ukraine and further development. Objectives of the study:

- to explore the theoretical and methodological foundations of energy security;
- to analyze the main indicators of Ukraine energy;
- to analyze energy prospects of the country;
- to develop recommendations for the improvement of the energy potential in the world market.

Methods: method of knowledge, comparison method, the historical method, the method of deduction and financial ratios. Information basis of work consists of materials of educational literature, books, articles, reports on the formation of organizational structure and materials of official institutions and organizations.

***Research  
results and  
discussions***

The problem of energy security of Ukraine has appeared as well as in the other countries, from the time of independence. The country faced a range of issues relating to the political, economic, military, environmental, informational, social and other aspects of state and society, which can be combined in the concept of "security". Stable operation of energy independence of Ukraine, the availability of competent staff, smooth supply of fuel redundancy of installed generation capacity

contributed confidence that this situation will continue in the energy sector in the future.

But in recent years negative trends in the energy sector have appeared. The energy sector lacks the investment of the necessary funds to update equipment upgrades, which leads to aging, accidents and operational readiness reduction. The reorganization of the energy mix led to a number of independent organizations, along with the loss of a single coordinating management of the energy as a whole.

Ensuring the economy and social sector with the main types of energy, raw materials for the chemical, oil and coal chemistry, metallurgy is assigned to the fuel and energy complex of Ukraine (Gray, 2010).

The globalization of energy markets, as the most noticeable trend in recent decades in the global economy as a result of significant growth in international trade in energy resources, as well as changes in technology supply, gradually eliminates the differences in consumer behavior in the regional markets, increasing vulnerability to crisis manifestations, the scale of which in the context of globalization is unprecedented (IMF, 2012).

The fact of the international market impact in any of the spheres of trade was confirmed by E. Heckscher and B. Ohlin, and until the 60th of XX century a model of Heckscher-Ohlin prevailed in the economic literature.

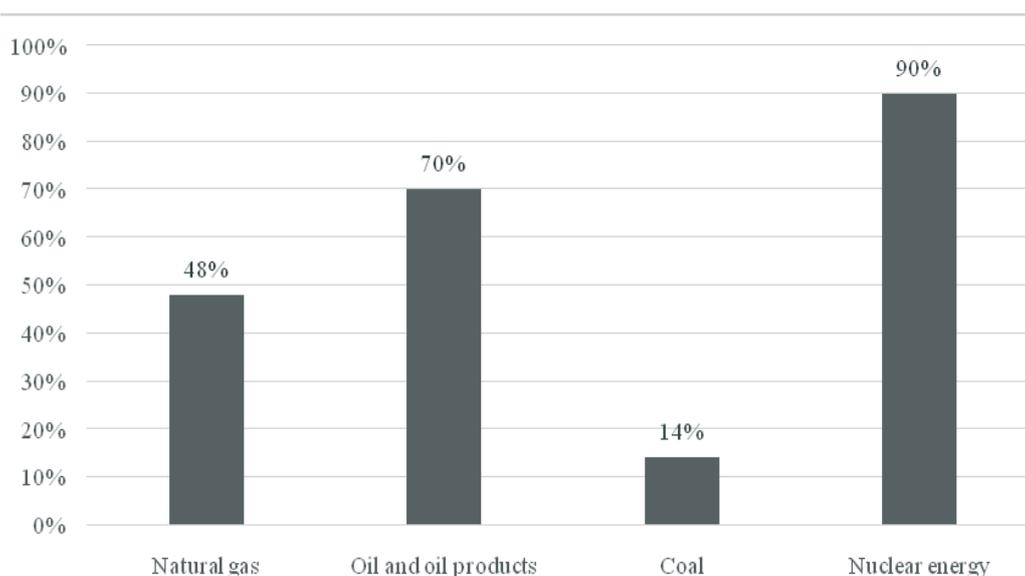
Thus, the international market allows each country to obtain the necessary –either to use its own export potential and due to its profit from selling energy or vice versa – to meet the need for scarce type of fuel by imports from countries with surplus resources and sell them to foreign markets.

One of the major trends of the global energy balance in the last decades was the increase of natural gas share – because of the complex economic, technological and environmental factors. Additional product features of natural gas have increased the production of liquefied natural gas (LNG). In addition, in recent years, there was made a bid (in the first place by the US) on shale gas (Kapitonov, 2012).

Natural gas market has substantial difference from other commodity markets, one of which is that the gas transportation in most cases takes the form of a natural monopoly because the construction of gas pipelines over long distances from places of production to consumers is very expensive and can be done only large consortia. The state represented by the government is responsible for regulating natural monopolies to prevent the abuse of their market position and to prevent possible energy crisis.

Based on the foregoing, it should be noted that the presence of the global energy market allows all countries regardless of whether their own natural resources to meet their needs, using channels of international trade, which offer access to the most geographically distant sources.

As we can see, Ukraine imports about 54-55 % of energy; according to the international standards such dependency is not considered



**Figure 1. Ukraine's dependence on energy imports, 2015, %**

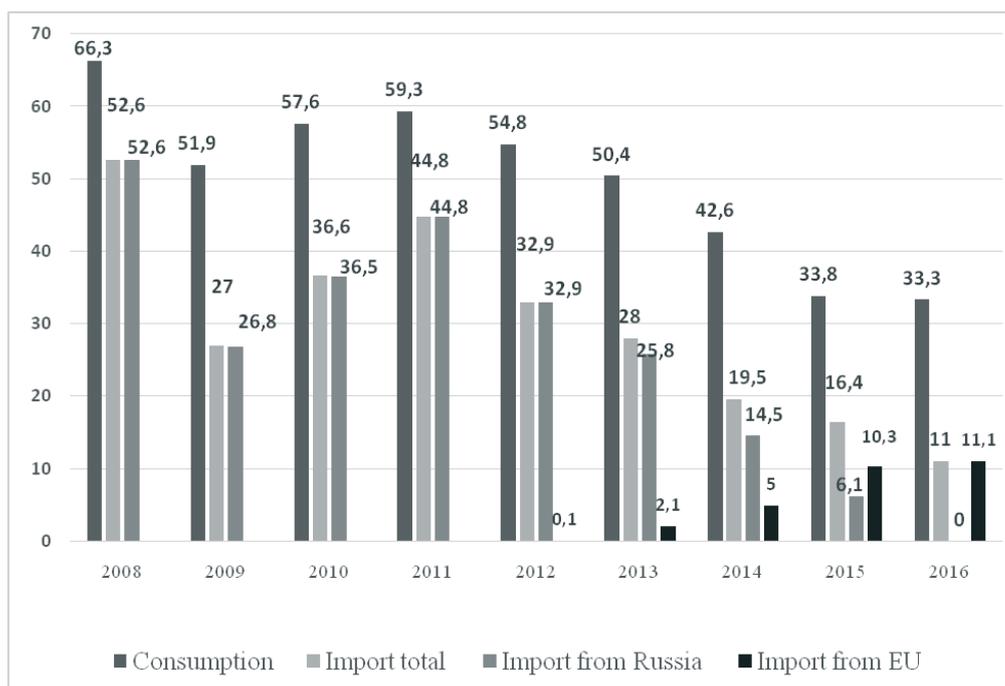
excessive. But the problem is that Ukraine receives the bulk of energy (about 60 % of imports) from one country – Russia – either directly or through its territory. Under these conditions, the dependence of power and economy of Ukraine as a whole on imported energy supplies is critical (European Commission, 2010).

Ukraine's energy dependence level is the European average and tends to decrease, however it is characterized by a lack of diversification of energy supply sources and especially oil, natural gas, nuclear fuel.

It is believed that the supply of energy imports is reliable if it is carried out from at least three sources, otherwise, the following negative consequences may come:

1. monopolistic energy price increases or restrictions of their supply in case of deterioration of bilateral relations with the exporter state;
2. critical dependence on exporting state, which complicates the development of equal bilateral relations;
3. reduction of energy supplies as a result of their production decrease;
4. prolonged disruption in the supply of energy in the event of major accidents on main oil pipelines (e.g., due to emergency situations of natural or man-made disasters, sabotage, aging pipeline networks, etc.).

World experience shows that in order to ensure the economic security of countries in the energy sector the state must comply with several principles.



**Figure 2. Imports of natural gas in Ukraine (billion m<sup>3</sup> / year)**

The first and most famous – diversification of supply. The second principle is stability, “safety margin” in the power supply system, which mitigates the effect of shocks and facilitates disaster recovery. The third principle – the recognition of the reality of integration.

The dynamics of the gas sector in 2016 maintains a positive trend of GDP’s gas content reduction by reducing the overall consumption of gas. Consumption has been well below projected figures. Following the results of 2015 its volume was at 33.3 billionm<sup>3</sup>, almost as of the 2015, when consumption was 33.8 billionm<sup>3</sup>. Of course, this decline has been observed primarily due to falling industrial production, and to a lesser extent with measures of gas saving, gas replacing and energy efficiency (Pashkevich et al., 2012). It was reported, that in 2015 Ukraine reduced gas consumption by 20,9 % (to 8.913 billionm<sup>3</sup>) compared to year 2014 – up to 33.727 billionm<sup>3</sup> (Kitchenko, 2012).

The greatest success of Ukraine was quite efficient use of opportunities of reverse gas supplies to Ukraine from the EU. In 2015, Slovakia and Ukraine have become strategic partners both in reverse and anti-project «North Stream-2». Almost 95% of reverse supply arrived in Ukraine by GTS of Slovakia with the help of Eustream (IMF, 2012).

The negative trend is a reduction of the production of own gas in Ukraine. The volume of gas production amounted to about 19.9 billion m<sup>3</sup>, the year before it was 20.5 billion m<sup>3</sup>. The most rapid fall of production demonstrates «Ukrnafta». Also, production decline was observed in «Ukrghasdobycha».

Now Ukraine ranks fifth in Europe (including Turkey) in terms of the use of gas. In 2014 Ukrainian consumers purchased 42.6 billion cubic meters of gas. About half of this amount (19.5 billion m<sup>3</sup>) were imported. Over 2014 public and private companies in Ukraine produced about 20.5 billion m<sup>3</sup> of gas. The remaining needs were provided by reserves in underground storage facilities.

Today Ukraine is one of the most energy-inefficient economies in the world. The energy intensity of the economy is 3,8 times higher than in the EU. At the same time, economic growth is usually associated with high energy efficiency and there is a clear need for a viable solution capable to increase energy efficiency or, more generally, the productivity of resources. Thus, lower levels of energy efficiency along with all the related problems such as dependence on imports and greenhouse gas emissions is a key development challenges for Ukraine today (Krugman, 1979).

Achieving energy independence is not only a question of economic viability of Ukraine; it is also a matter of national security, sovereignty and survival as a state.

Ukrainian economy is running on natural gas. About 40 percent of the country's energy consumption comes from natural gas, at least half of our supply historically came from Russia.

The structure of the Ukrainian economy is characterized by a large share of material- and energy-intensive industries. It results into the fact, that the achievement of developed countries' energy consumption level, without the restructuring of the Ukrainian economy, is impossible.

However, the estimated potential of reducing energy consumption through efficient use of energy resources, according to calculations and conclusions of the Energy Strategy of Ukraine until 2030 and beyond, is 51,3 %. Realization of this potential can significantly reduce the consumption of energy resources, which will take the edge off the problem of external energy dependency. Thus, the problem of energy efficiency in its strategic importance is not inferior to the issue of diversification of energy sources, as a consequence of inefficient FER is the high cost of production, works (services), which reduces the competitiveness of the national economy.

Thus, we can define the following areas the of power supply problem in Ukraine:

National:

1. Domestic extraction (natural and shale gas, oil);
2. Alternative energy;
3. Energy conservation .

Conditionally national (international):

1. Diversification of supply;
2. The increase in traditional exports, as a result of GDP increase which will decrease an urgent need in diversification.

The average energy industry of Ukraine fixed at 51 % of the EU level. These results are recorded in the third the energy efficiency rating of regions of Ukraine Ukrainian Energy Index 2013, presented Oct. 16 at

the Forum on renewable energy and energy efficiency. Energy efficiency of agriculture Ukraine since its previous rating rose by 5 %, but this figure is still low in relation to the EU – 37 % (Kader, 2010).

In the medium and long term in the energy market LNG and probably gas from unconventional sources (primarily shale gas) will play a key role. In future, LNG could reach the leading position in the gas market, especially the segment of LNG trade will continue to grow rapidly. However, the prospects for production and trade of gas from unconventional sources is currently uncertain. Many countries are interested in the development of gas production from unconventional sources, however, only the United States have managed to establish its commercial production so far.

In many countries around the world transition to clean energy is being put into effect. According to the data of 2013 16 countries have achieved 100 % electricity from renewable sources (Fitch Ratings, 2015).

Although renewable energy in Ukraine has great potential, it is still barely used. The main reason for the low level of activity in this area is that the legislative and institutional framework are not sufficiently advanced to ensure the implementation of a large number of potentially feasible projects in this area (Global Footprint Network, 2011).

To attract entrepreneurs to participate in the implementation of projects for sustainable energy development, the European Bank for Reconstruction and Development (EBRD) has launched the Program of Sustainable Energy Financing in Ukraine (USELF).

To support the projects, financing and implementation of which is often challenging, the Program not only provides the necessary financial resources, but also technical assistance for local market participants.

At present time there is a clear trend towards increasing energy consumption in the world (energy balance around the world based on fossil fuels), although the hydrocarbons remain the dominant energy in the global energy mix.

In domestic energy sector many problems have been accumulated, mainly due to depreciation of fixed assets. Solution of these issues requires constant huge capital investments, which in the current economic system is inadequate and may cause the continuous growth of tariffs for energy. Further development of these processes, along with the inevitable rise in fuel prices may lead in the future to the extensive development of the economy and industry (Becvar et al. 2011).

### **Conclusions**

Today Ukraine is in a globalized economy, so any resolution of the energy dependence issue in any way relates to international aspects – whether direct trade in energy, or international relations.

It should be noted, that the fuel and energy complex is the basis of economic development, an instrument of domestic and foreign policy. Major part of the GDP of many countries is formed by the energy industry and through proper implementation and domestic use of energy resources (International Energy Agency, 2006).

Current condition and prospects for Ukraine in international markets of natural gas and other energy resources directly dependent on timely and adequate response to the changes taking place, considering the potential risks and complicating factors.

Based on the identification of promising trends of the energy market by attracting investment targets to link supply-side grid. These also include: the development of energy saving and environmental introduction of more efficient technologies, renewable and alternative energy sources, increase return of deposits, creation and modernization of infrastructure for transportation and storage of energy and others. To reduce investment risks and promote stable energy flow it is necessary to promote economically sound diversification of contracts that will strengthen energy security, improve resistance to manifestations of the crisis in the global energy market. Thus, all above mentioned requires further research and systematization.

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