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ENERGY INDEPENDENCE OF UKRAINE: ACHIEVEMENTS AND PROSPECTS

The article provides a retrospective analysis of market transformations in Ukraine's energy sector in terms of efficiency of creating competitive commodity markets. The author identifies the basic factors causing structural changes of this country's energy balance during 1991-2016, among which the following ones would be emphasized: separation of the state's energy system from the centrally-planned single energy system; the uneven decline and increase in the output in individual sectors causing an uneven demand for energy resources; inconsistency of the reforms on individual energy markets and the consequent imbalances in the logistic pattern of the national energy supply (energy, financial and information flows).

The analysis the structural and price disruptions in Ukraine's energy balance shows that, at present, the market mechanism does not ensure the optimum allocation of resources. This situation is the result of the different approaches to the formation of competitive structure of the energy markets and market pricing mechanism. The initial boost in the market reforms towards liberalization was eventually changed to the concentration of national assets that in the end retained the state-monopoly structure, even on the potentially competitive, by their nature, energy markets.

Market deviations already at the stage of formation distort the objectives and effectiveness of their operation, which devalues the effect of the transfer of ownership. The privatization of energy assets has failed to create preconditions for the formation of a competitive structure of the market of natural energy monopolies and led to the consolidation of the market power of the energy monopolies.

The author considers the structural changes in the energy balance and the dynamics of prices for fuel and energy resources (FER) and makes a comparative analysis of Ukraine with European countries by major energy efficiency indicators, showing the differences between Ukraine's structural and technological characteristics with the corresponding average rates. There is a dynamics of the basic indicators of this country's fuel and energy complex in the context of the use of the available resource potential. The author gives an assessment of the achieved level of energy security and sustainability of energy situation compared to other countries.

By the results of the international ranking of energy sustainability, Ukraine occupies one of the lowest positions among the industrial countries. A factor analysis of energy efficiency policy urges for enhancing the improvement of the institutional mechanisms of the modernization of energy systems based on European experience. Energy efficiency is one of the key elements in the competitiveness of Ukrainian goods and services and an important factor of economic growth in Ukraine.

The article deals with the key issues in Ukraine's European integration in the energy sector, in particular as to the requirements of the Second and Third EU Energy Packages. The verification of the process of Ukraine's European integration in the energy sector shows that our country shares and accepts the European principles, objectives and criteria for sustainable energy development, but does not apply European methods of task solution, in particular as regards the transparency of the policy measures, consensus of all stakeholders, mechanisms of planning and forecasting (modern decision support systems and risk management, energy foresight,

and technology platforms), responsibility for delays in plan fulfilment and poor management, weak coordination between state authorities (duplication), social activation of the energy policy (public involvement) and others.

The article outlines the prospects of achieving the maximum possible energy independence of Ukraine. Current challenges for this country's energy policy are derived both from the specific features in the transformation of the energy sector and branch structure of the economy, and from the global geopolitical and economic trends on the world energy market, which over the last decade have changed significantly. Ukraine's response the same as that of most industrialized countries consists in reviewing the national energy strategy, whose main provisions are currently under discussion among experts.

Key words: energy policy, energy security, energy balance, energy sustainability, energy efficiency, decoupling, diversification.

JEL: Q40, Q41

A problem of energy supply for Ukraine's national economy arose at the same time when this country became independent. In the next 25 years of independence it has remained but the most difficult challenges for the country's national security. The fuel and energy sector (FES) of Ukraine that had formed during the Soviet Union period turned out to be inconsistent with Ukraine's resource potential. Power supplies system of the new country turned out to be affected by disproportions. In conditions of full-blown non-payment crisis and deficit of her own resources Ukraine found herself on the verge of collapse of her publicly run power supply system, ridden by the risks of technological accidents, left at that time alone to confront the effects of the largest of such accidents, that of Chernobyl nuclear power plant.

Looking back to the events of the last decade of the previous century one can safely affirm that through tremendous efforts and some times against all the odds Ukraine managed to escape rather probable power supply collapse. And as even these days supplies of energy resources continue to be part of critical Ukrainian imports, the energy industry reforms made at that time put Ukraine on the path of irreversible sovereign development. More than that, Ukraine has set an example of dramatic steps aimed at liberalization of natural monopolies by accomplishing whole sale market for electricity, the largest in Europe at the time and the most innovative in its energy sector.

Components of energy system inherited from the Soviet Union, like coal mining industry, natural gas transit system of pipelines and a powerful nuclear power industry turned out to be an "energy airbag" for Ukraine. The role of these segments might not remain as important though in the future because of their degradation over time. Modernization of Ukraine's FES is therefore extremely pressing. Energy efficiency and use of alternative types of energy are getting more and more significant.

As the EU member states have created common vision of energy policy and many values, energy supplies have become even more interesting for Ukraine and it has formalized her strategic choice of European integration. Let us therefore

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make an overview of Ukraine's achievements in the energy supply area and of some problems that would require solution in the future. It is even more interesting that Ukraine is going to promulgate a new Energy Strategy 2035 that has been determined by recent events and challenges to its national energy security.

It should be noted that energy security of a country assumes not only sufficiency of energy supplies for its economic development being obtained entirely from national energy resources of various sorts, because such sufficiency is quite rare worldwide. We rather mean by it a country's capacity to meet any challenges and threats in a country's energy sector. We mean by it therefore a guarantee of stability of energy supplies in Ukraine through their reliability and steady development of energy industry. We consider that assumption to be in compliance with modern understanding of national energy security.

The need to acknowledge these new realities of situation with energy supply system has made Ukrainian researchers to look for new approaches to the assessment and planning of the development of national energy industry. A number of systemic works on these problems have been published by a number of prominent Ukrainian experts in energy realm – Academicians of the NAS of Ukraine A.Shidlovsky, A.Dolinsky, I.Carp, M.Culic, B.Stognij, I.Segul. One of these works can be mentioned specifically, as it is a series of books "The Energy Sector of Ukraine at the Start of the XXI Century" [1]. These publications though make emphasis on a generalized assessment of the technological and economic status of the FESC of Ukraine. The problems of formation of competitive markets of energy resources remain yet to a large degree unexplored. Although there have been scientific researches of a number of branches of FES (e.g. Academicians of the NAS of Ukraine O.Alimov [2], O.Amosha [3] the key problems of FES crucial for energy security of Ukraine, although being tackled, are tackled slowly due to the lack of scientifically proven recommendations. Among these problems are modernization of the main assets of FES, efficiency of the consumption of fuel and energy resources (FER), diversification of their supplies, tariff policy, European integration of the energy supply system of Ukraine.

Permanent quest for optimal decisions accompanies the implementation of energy policy. These decisions though are often changed due to the lack of consensus among the government, business and society in regard to strategic milestones. It would be enough to recall varying vectors of national energy programmes and strategies. The National Institute for Strategic Research lay stress in its activities on solving the problems of energy security as a component of national security (as in e.g. [4] and [5]). Academic research and expert evaluations of the problems of energy security are focused predominantly on internal problems of energy industry and markets of energy resources. We can at the same time point out that solution of the problems of national security in its energy domain is impossible in the conditions of globalization without an activation of the integration processes and Ukraine's admission into the institutions of collective (European) energy security.

Energy security as an autonomous object of academic research and as an important component of national economic security (along with food, financial, in-

formation, etc.) was raised for the first time in Ukraine in the works of Professor I.Nedin, who practically founded Ukrainian national school of energy sector economists. Permanent academic workshop "Economic Security of the State and Its Science and Technology Aspects" ("The Nedin Readings") [6] has in recent years become a venue for an exchange of results of research on this topic among broad circle of international scientists.

Generalization and interim results of market reforms in the energy sector of Ukraine since her independence is the scope of the article. The article therefore reviews structural changes in the energy balance and dynamics of prices of FER; dynamics of the main indicators of the FES operation; results of the formation of the markets for energy resources; the issues of Ukraine's European integration in the energy sector and the prospects of Ukraine's attaining the most possible energy independence.

Energy resources potential of this country is an aggregate of proven and prospective deposits of fossil fuels and traditional and renewable sources of energy. Ukraine possesses 3,5% of proven deposits of coal, 0,1% of oil reserves, 0,7% of natural gas. Ukrainian deposits of coal are estimated at 300 bln metric tons. Initial extractive reserves of fossil fuels in Ukraine amount to 8,4bln t of equivalent fuel (e.f.). Prospective resources of fossil fuels are estimated to be 4,9 bln t in e.f. 1,13 bln t out of those are oil and condensate, 3,86 trln cubic metres are gas. Remaining non-proven resources of hydrocarbons in Ukraine are estimated at 4,96bln t in e.f. (1,1 bln t of oil and condensate and 3,86 trln m³ of gas). One third of the resources of gas and one fifth of oil deposits are located in the basins of the Black Sea and Sea of Azov. 48,7% of potential resources of hydrocarbons located in Ukraine's land have been developed so far and 3,9% of the potential deposits in the sea [7].

Indicators for extraction, import, export, processing and consumption of these resources are assessed in the form of energy balance, which is the main source of information for determination of the flows and amounts of energy resources of Ukraine.

Approximation of the formation, monitoring and forecasting of the energy balance of the country in accordance with strategic criteria and programmes of socio-economic development is an important pre-requisite for the efficiency of energy policy. Energy balance is an essential source of information for operational management and strategic planning of the development of FES and for the regulation of the markets of energy resources to the end of its energy efficiency.

We must admit though that for a long time criteria of FES development and of energy consumption were considered without systemic analysis mostly through the prism of the formation of resources and deliberation of their apportionment. The situation with the development of the energy balance of Ukraine somewhat changed after she became an independent state and transitioned towards market economy. The State Planning Authority lost its functions pertaining under planned economy. It was transformed into the Ministry of Economy of Ukraine, whose key function was to develop market relations. Department in charge of

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energy industry was dissolved and department in charge of energy market was established in its stead. There were no managerial structures at that time interested in developing fuel and energy balances, that is to say that the influence of the state on the parameters of fuel and energy balance was weakened. Only in 2013 after a few years of work upon the recommendations of the NAS of Ukraine the State Committee for Statistics published the energy balance of Ukraine according to the methodology and format of the OSCE.

Understandably, the outlook of the energy resources of today is only a first step in the development of energy sector. National Energy Programme of Ukraine to 2010 enacted by a Decree of the Verkhovna Rada of Ukraine in 1996 became the first document planning the development of the FES. But it only became known to a limited number of professionally involved experts. Yet after just a few years it became clear that it was not enough to limit these efforts to mere modernization of energy infrastructure. But the powers that be were lacking in understanding a methodology of strategic planning of energy sector development under the conditions of emerging market economy.

They understood that power generation in energy system needed to be restructured, that policy of creation of competitive energy markets should be commenced, energy supplies should be diversified and energy should be consumed more economically in all spheres of life. Capital intensity and inertia of the development of energy sector were the reasons for a change of the horizon of the planning process that should take into account the medium life cycle of assets in energy sector (30 years). National Academy of Sciences of Ukraine presented this initiative to the President of Ukraine. The Academy in essence became chief coordinator of the development of the Energy Strategy of Ukraine to 2030. This document was enacted by a decree of the Cabinet of Ministers of Ukraine in 2006 and included ambitious plans of development of Ukrainian energy sector with maximal use of national reserves of energy resources mostly through the development of coal and nuclear energy industries.

Implementation of the planned measures was slowed down from the very outset owing to the lack of funding with the need of that estimated at 30 bln US dollars. Besides, privatization of electric power and oil refinery industries was initiated, thus creating the new owners, who should have further developed the capacities of those industries. In the end the programme did not take off and the Strategy was mainly used as a kind of a formal pretext for reallocation of funds of the national budget among various special interest groups of the energy sector. It became clear that methodology of strategic planning in power sector should be altered and the process of planning should be made perpetual, the reference benchmarks should be adjusted according the changing dynamics of energy markets.

All these tendencies made the government initiate the review of Energy Strategy and its new version went into effect 24 July 2013. Some of the priorities were somewhat altered to the development of oil and gas segment and increase of the share of the alternative/renewable sources of energy (Ukraine ratified the UN

Framework Convention on climate change and joined the Protocol on the foundation of Energy Community).

With these new priorities in place the reference indicators were to be reviewed since 2014 on the basis of the revised forecast of the dynamics of the energy markets and balances of the FER. Instead the change of the geopolitical situation in after the Revolutsiya Hidnosti (Majdan) once again made the question of energy security of Ukraine and the need to change priorities of energy policy more pressing.

Without delving too deep into the documents listed above for the sake of brevity of this article, the author can express his own view that their common deficiency was that the common energy policy was formulated on the purely sectoral approach. This led to the oligarchic oligopoly in Ukraine's energy sector. Therefore in all the quarter of a century of Ukraine's independent existence a balance of interests of the government, business and society has never been reached.

Returning to the energy balance of Ukraine as a subject of economic analysis one can state that in 1991-2016 the energy balance of Ukraine has underwent notable, although not radical structural changes. These mostly boil down to the lessening of the share of importation of energy resources in the overall energy supplies and to the wider use of natural gas in the generation of electricity at the thermal power plants (were substituted by coal extracted in Ukraine) (Chart 1).

According to the IEA, in the overall energy consumption in Ukraine at the time she proclaimed her independence the share of coal was 29,2% and 36,9% was natural gas. Although certain share of gas was substituted by coal, their balance is still not rational enough (in 2013 coal was appr. 35,8% and natural gas 34,0%). In Poland, where coal is staple domestically extracted fuel similar to Ukraine) this proportion is more rational: coal amounts to 54,3% and gas 14,1%. All that is to say that in Ukraine the structure of initial energy consumption is still inconsistent with its mineral resources potential and internal structural diversification has not occurred either in the extraction sector, nor in processing. Neither external energy supplies have been diversified.

Gasification of Ukraine as industrially developed territory took place on a large scale in the 1970-s and 1980-s. It made gas dominating in the Ukrainian energy consumption structure, especially in power and heat supplies, as well as a raw material in chemical industry (Charts 2 and 3). The largest consumers of natural gas remain residential areas, power plants, steel and chemical industries. Annual consumption of gas in Ukraine in industrial sector amounts to 25-30 blnm³. Utilities consume 15-18 bln m³, public sector enterprises use 2-3 bln m³, Ukraine's population consumes 17-19 bln m³. Around 7 bln m³ are used by the gas pipeline system for its own technological needs.

Fuel and energy sector is one of the essential parts of economic security guaranteeing the operations of all the other sectors of Ukraine's economy. The energy sector of Ukraine has numerous problems owing first of all to the technological wear of equipment and machinery and lack of funds for even simple recreation.

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Systemic approach is needed to deal with these problems with the investments from non-governmental sector being its foundation. Management in all related industries of energy sector should be improved and progressive government legislation should be enacted.

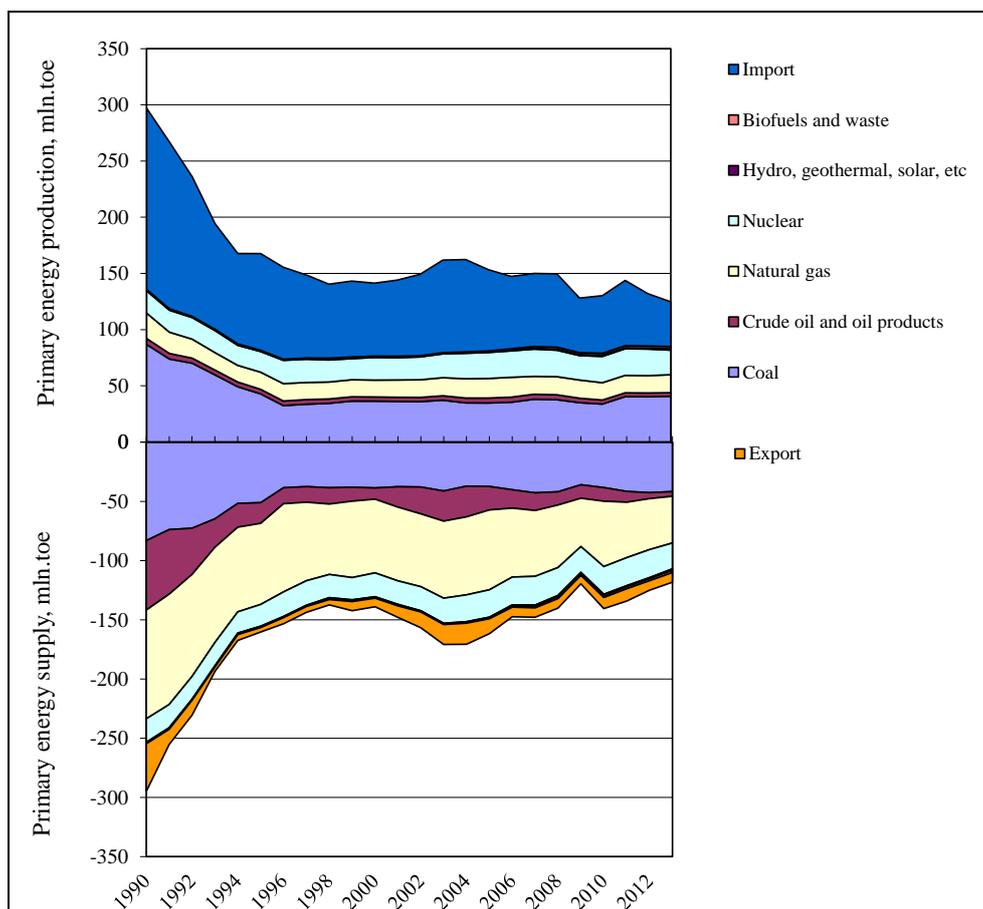


Chart 1. The structural dynamics of the energy balance of Ukraine

Source: International Energy Agency.

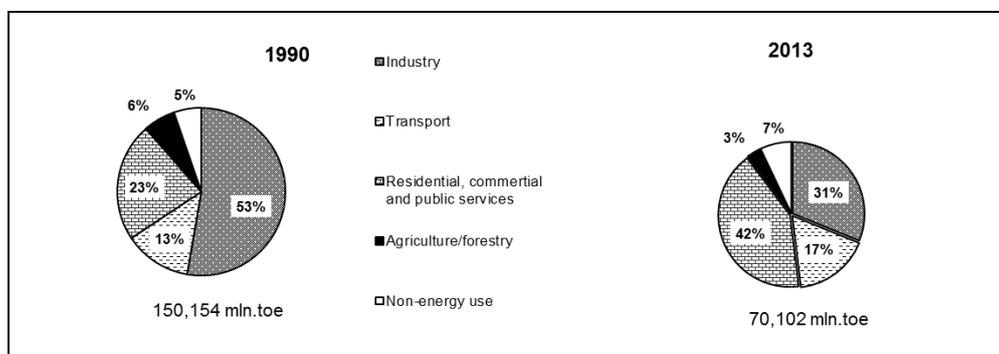


Chart 2. The structure of the end consumption of FER

Source: International Energy Agency.

At the beginning of this millennium Ukraine covered up to 60% of its consumption by domestically produced FER. Coal covered 21,8-25,6% of this share of consumption, natural gas 9,2-11,3%, oil (oil products) 2,6-2,8%, 11,5-16,0% were electricity and heat generated by nuclear, hydro-electric and geo-thermal plants and other producers of energy (fuels).

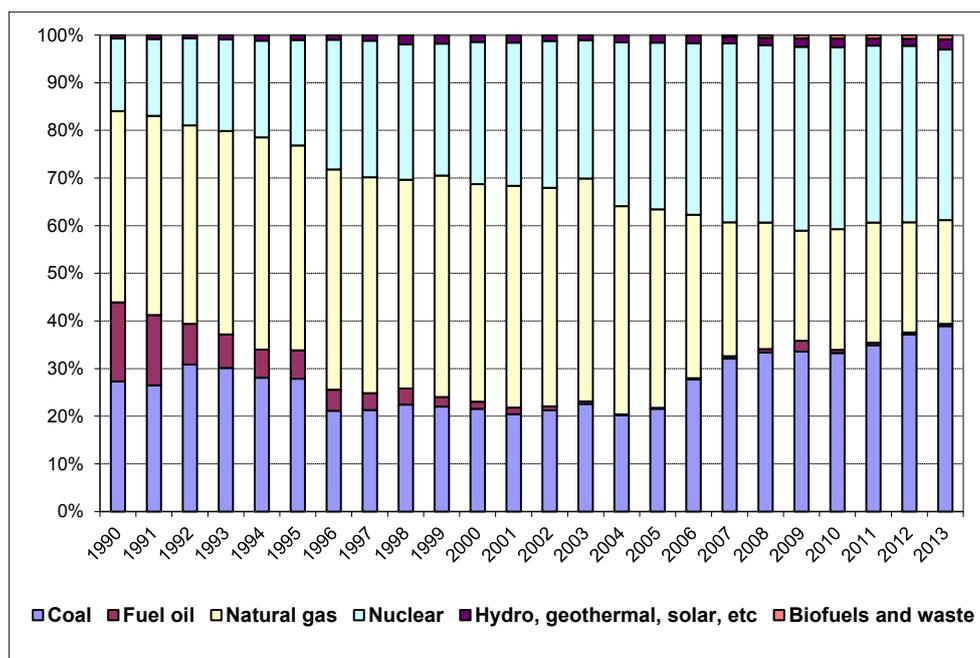


Chart 3. Structural dynamics of consumption of FER in electric and thermal energy generation

Source: International Energy Agency.

The fall in the output of primary FER was achieved only in 2010 (Chart 4). Ukraine's FER meets about 47% of the country's demand for primary FER now. 40,9% of hydrocarbons extracted from the soil are used and only 3,9% of those extracted from the sea, which cannot be considered satisfactory level. Ukraine's electricity demand is satisfied exclusively through domestic production. But irrational work schedules and lack of funding for modernization of generating capacities have caused significant wear of capital assets of enterprises of electric energy sector. This means that the country has large potential for increase of production of her own fuel resources. Preliminary calculations demonstrate that Ukraine can meet her demand in oil for 25-35% and gas for 50-60%.

Formation of any energy market, that of Ukraine's included, is driven by its own internal logic and is not capable of drawing uniform conclusions concerning internal relations inside energy market of a country. The markets of secondary energy resources (electricity and oil products) are developed more dynamically as a part of internal market of Ukraine than the markets of primary energy resources (oil, coal, natural gas). Price policy determines at the same time price disproportions in energy markets with prices of primary energy resources grow-

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ing more dynamically. This owes to administrative regulation of prices for the products of natural monopolies. At the same time price dynamics at the markets of primary fuel resources are mainly determined by the situation in world markets. These circumstances provoke weakening of financial stability of energy companies, cross-subsidizing of inefficient businesses and in the end the growth of energy consumption in real sector of economy. Social impact of these tendencies is offset by imperfect system of accounting and payments for consumed energy. Problems with unstable payments for consumed electricity and lack of stimuli for reduction of non-regulated losses in electricity networks persist despite some positive developments that made operations of privatized companies more stable. Among the latter are the compliance of the new owners with their commitments and the improvement of the level of their management.

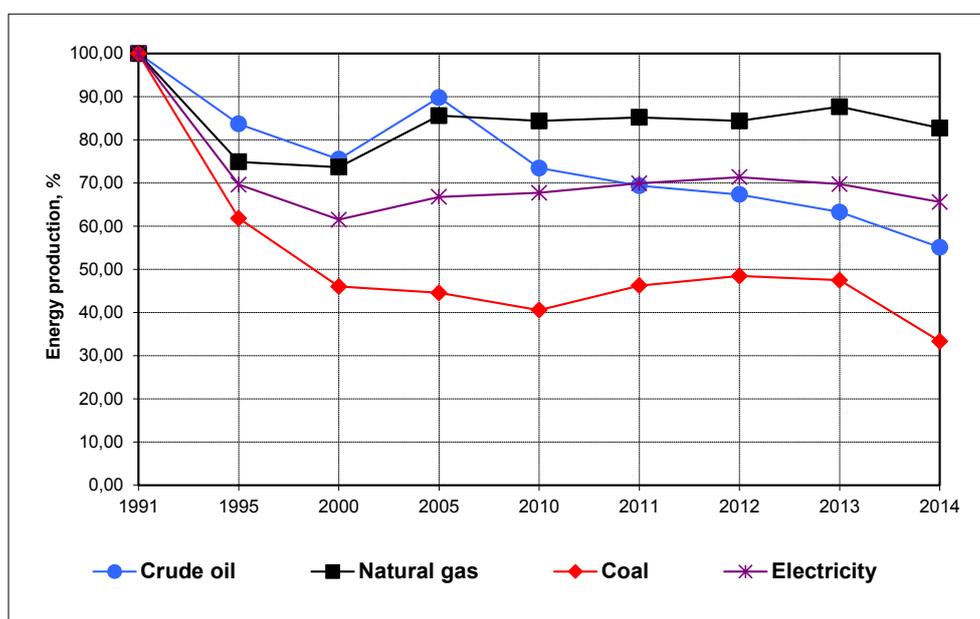


Chart 4. Dynamic of the FER production in Ukraine

Source: State Service for Statistics and International Energy Agency.

Systemic analysis of the structure and institutional basis for the development of Ukrainian markets for energy resources shows that stabilization measures for energy security were the main short term scope of creation of that basis and not a consistent establishment of competition pertaining to a pattern of market relations that had been selected for that or the other segment of energy market. It caused substantial structural and pricing imbalances in Ukraine's energy balance and changes in the structural and proprietor forms of energy companies that were not under control and hence not regulated by the state.

Considering peculiarities of Ukraine's energy markets and new challenges to its energy security under the circumstances of world economic crisis one needs to take stock of the fact that the recession in international economy is accompanied by the fall in the world oil prices. The issue of what has been determining these

developments remains subject of discussion in academic and expert circles, although majority of them seem to agree that they are influenced by one another. Sluggish demand for energy resources in world market and lower prices create favourable opportunities for institution of Ukraine's domestic stabilization fund of oil and oil products. Introduction of European prices for natural gas in today's conditions means slowing down of Ukrainian GDP growth rate. As Ukraine is a party to the Energy Charter and given the peculiarities of the structure of Ukraine's market for natural gas, negotiations on prices for gas imports should be transparent, with participation of the governments of the countries that supply, import and transport natural gas.

Among the peculiarities of institutional structure of Ukraine's energy markets is a dualism of the elements of liberal and monopoly concepts. Rapid liberalization of the monopoly nature of these markets with the establishment of unparalleled (even for the EU member states) wholesale market of electricity in Ukraine was transformed in the mid-nineties of last century into the trend of concentration of energy assets and establishment of large national joint stock companies (like National Joint Stock Company "Naftogaz Ukrainy", NJSC "Energy Company of Ukraine", NJSC "Vuhillia Ukrainy" and others). This trend was on display not only in transit lines segments, but also in those potentially competitive (oil products, coal). In fact, after privatization of local oil refineries it seemed logical that a powerful and influential Ukrainian vertically integrated oil company could be created, but it turned out not to be possible. In practice transition from the government management of corporate rights executed by the ministries to the stock company management occurred. Privatization of energy assets did not bring about competitive structure of the markets of energy resources. Today's status was shaped by the overall Ukrainian state monopoly concept of apportioning of resources and by the local situation of production facilities.

Already mentioned dualism of Ukrainian market of energy resources is its peculiarity. There is the supply side like internal extraction and importation, and the side of demand (population, government run institutions, enterprises, utility companies on the one hand and corporations on the other). This causes dual pricing system, the so-called cross-subsidies that do not allow price signals to manifest themselves as stimuli for restraint (like energy efficiency) and changes of structures of both supply and demand. Regulatory functions as a rule boil down to setting certain price ceiling for specific segment of the market instead of controlling super-profits obtained from abusing monopoly position or unfair competition.

Despite the laws regulating the activities of natural monopolies and safeguarding competition, it is not possible to calculate, analyze and determine if monopoly prices are justified, because the monopolies do not operate transparently. This strengthens the market power of energy monopolies as they are the only ones who know the "economically justified tariffs". And as independence of the government regulation agency is only declarative and institutions of civil society do not guarantee economic sovereignty of consumers, the income is not redistributed from the producers to consumers via competitive formation of prices, on the con-

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trary. Government subsidies for the residents, although constraining social tensions, do not resolve the problem of imbalance of entire energy infrastructure. This only intensifies inequities inside a triangle balance of interests of the government, business and public.

Price disproportions in the markets of energy resources are constituted by the prices of primary fuels (oil, natural gas and coal) growing faster than those of the secondary (electricity, heat) (Table 1). This is the result of administrative restraints of the growth of prices instead of the economically justified regulation of prices of the products of natural monopolies. Dynamic of the prices in primary fuel markets (oil and gas) is set through the world market mechanisms. This situation causes the deficit of Ukraine's balance of payments and lessens financial stability of national energy companies.

Table 1

Indices of prices of industrial producers and of consumer prices

Index	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	<i>December to December of preceding year, %</i>														
Indices of prices of industrial producers by sectors															
Industry	100,9	105,7	111,1	124,1	109,5	114,1	123,3	123,0	114,3	118,7	114,2	100,3	101,7	131,8	125,4
Extraction of energy raw materials	88,1	110,4	113,0	126,4	126,3	117,1	128,4	107,7	110,6	139,1	116,3	104,1	102,4	125,6	159,8
Production of coke, oil products	106,6	125,5	122,9	177,9	103,3	109,4	150,4	84,4	142,9	125,1	115,9	92,7	99,2	150,1	104,7
Production and distribution of electricity, gas and water	100,2	107,0	101,9	113,0	113,1	123,4	120,9	142,2	103,9	112,5	121,0	109,1	105,2	128,5	133,2
Consumer price indices for main categories of goods and services															
Electricity	100,0	100,0	100,0	100,0	100,0	156,1	100,0	100,0	100,0	100,0	122,9	100,0	100,0	111,3	166,9
Natural gas	99,9	100,2	100,4	102,3	101,2	180,6	100,0	154,1	100,0	150,1	100,0	100,0	100,0	162,8	373,0
Hot water, heating	108,0	100,4	111,4	111,8	115,9	214,6	115,1	130,7	106,7	106,2	115,1	99,5	99,8	146,9	178,4
Fuel and lubricants	67,0	149,5	101,0	161,6	124,5	102,9	136,2	91,7	146,0	113,9	130,9	106,9	96,4	160,7	112,5

Source: State Service of Ukraine for Statistics.

Resilience of Ukraine's internal market of energy resources to external factors is determined by the adequacy of its structure for a system of institutional support. It is quite inadequate. At the time when risks and perils to the energy security of Ukraine grows, Ukraine's market structure and system of its governmental

support should add to its resilience and offset potential negative impact. The need for that was seen most clearly during the latest international economic crisis. Efficacious structure and regulation of Ukrainian markets should cause an effect of self-regulation and adaptation to new challenges. Energy efficiency policy should be upgraded in the energy sector itself and in the segments of end consumption of energy resources. Pre-requisites of the development of new segments should be instituted (for example, renewable energy sources) conducive to internal and external diversification of energy balance.

This means that the existing market mechanism does not make the resources distribution in Ukraine reasonable, neither does it affect changes in the structure of the demand through improved energy efficiency. Methodology of the formation of prices is based upon a spending approach and does not reflect deficit of energy resources and their interchangeability. Disproportions in tariff policy and pricing are the consequences of anti-crisis regulation by the government, of regional differentiation of tariffs and of cross-subsidizing of residential consumers instead of industrial sector. All these significantly worsen economic efficiency of Ukraine's energy balance.

Upgrading of Ukraine's competitiveness in respective international ranking is a target indicator in the implementation of the Reform Strategy 2020 (entering into the top 20). Ukraine's place in the Global Competitiveness Report today is 84th out of 148. Experts of the International Institute of Management from Lausanne point out among the reasons of Ukraine's lagging behind high energy intensity of the country's economy [9]. The reason for that is not only obsolescence of manufacturing facilities but rather falling production and the increase of the share of operational costs in the cost of production. Energy intensity of manufacturing will be reduced if production itself grows. Energy efficiency improvements and their effects can only be seen after the threshold costs of production equal the price of a unit of reduction of energy consumption. This will be much more effective than establishing state-run or non-governmental funds for energy saving.

Structural and price distortions of the energy balance of Ukraine intensify the risks for stability of energy supplies to this country. We assume energy security as a status of energy infrastructure guaranteeing technologically safe and economically viable satisfaction of current and future needs of energy consumers and protection of the environment. Apart from energy intensity of the economy there are some other indicators of energy security of Ukraine: level of self-sufficiency in energy resources; availability of energy resources transit system; share of prevailing energy resource in the overall structure of energy supplies; proportion between the end consumption and the overall energy supply, etc. Solution of the problems of energy intensity of production and energy supplies to the economy are among the main requisites of sustainable development of society, and these problems were in the last years and remain a key peril to Ukraine's economic and hence national security.

Usage of IEA's methodology of indicative analysis allows to compare the countries, which is very important. It is not limited though by a set of known in-

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dicators. Analysis of energy security of the nation assumes application of other indicators of energy security. One can take as an example the IEA's analyses of the situation with energy security of economically developed and other states [10], specifically the overview of the energy policy of Ukraine in 2006 and 2010 and deepened overview of the energy efficiency policy and programmes of Ukraine (2013) using indicators of the levels of consumption and energy efficiency of some of the FER (oil, gas, coal, nuclear energy, hydroelectric power and others), regional aspects of energy consumption, transit capacities and transit flows of main FER, energy dependency, prices, etc.

Comparison of energy indicators of different countries of the world calculated according to the data of IEA demonstrates inadequacy of Ukraine's position in energy and economy outlook. From 1992 on energy intensity of Ukraine's GDP was growing in parallel with the reduction of energy consumption per person (Chart 5). Owing to that Ukraine found herself among net exporters of energy resources according to the indicators of energy efficiency.

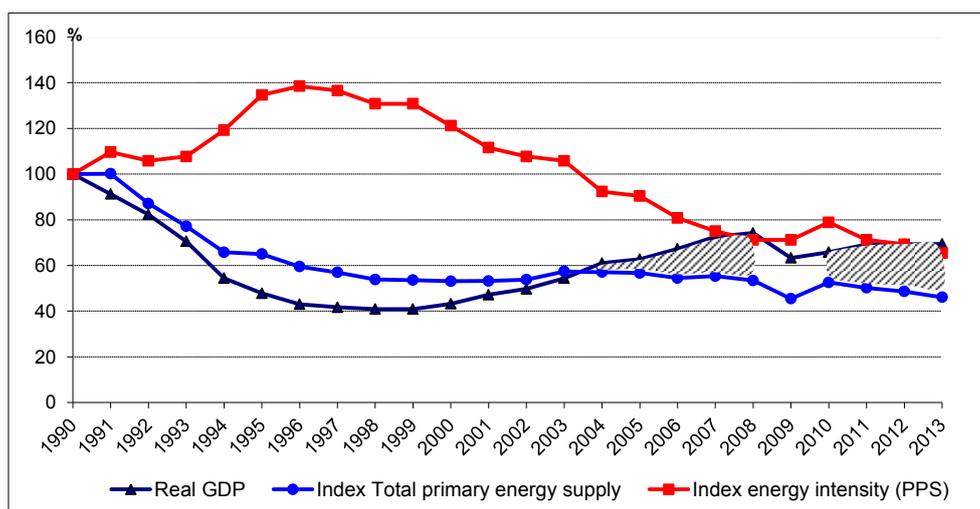


Chart 5. Dynamics of energy intensity of Ukraine's GDP including periods of decoupling

Source: GDP data supplied by the State Service for Statistics, energy consumption data – by the IEA.

After the beginning of economic growth in Ukraine positive trend of reduction of energy intensity of the GDP was registered. In accordance with the IEA's data, energy intensity of Ukraine's GDP in y 2013 was 0,34 kg n. e./US dollar (PPP). But it still remains quite high, almost three times higher than EGDP of economically developed states (average indicator for OECD countries is 0,13 kg n.e./ US dollar (PPP) that makes Ukraine keeping her economy competitive through selling national products at dumping prices, reducing costs of labour, etc. Structure of Ukraine's energy balance differs from average indicators of the OECD and EU countries (Chart 6). Therefore, despite some reduction of energy intensity of Ukraine's GDP, she continues to consume too much energy resources and tries to

maintain competitiveness of her economy by reducing the cost of labour and circulating capital of enterprises, funds for long-term investments in modernization of her manufacturing facilities. Hence the need to take into account the level of energy intensity of the GDP while preparing prospective energy balances and identification of factors affecting energy intensity of national economy.

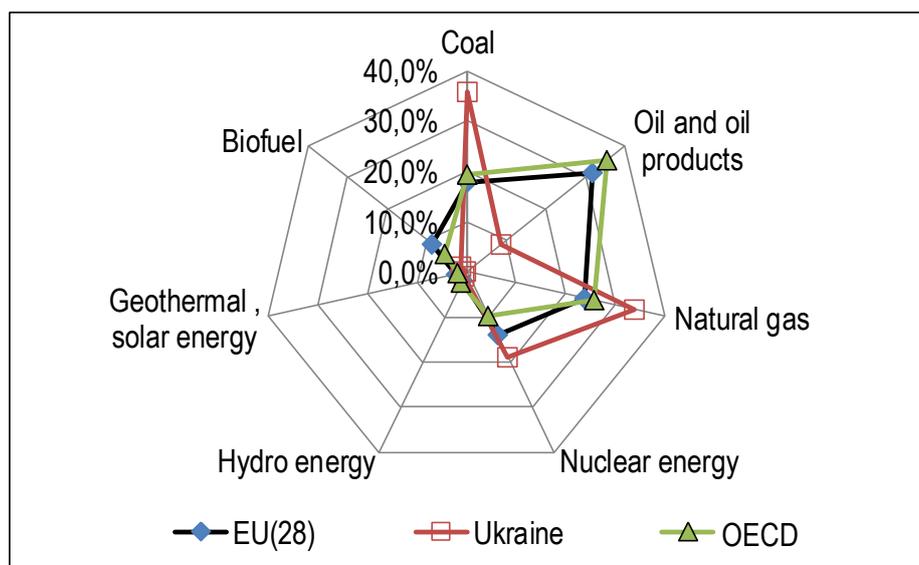


Chart 6. Structure of energy balances of Ukraine, EU and OECD

Source: International Energy Agency.

Ukraine is without a doubt an energy deficient country and this can be viewed as a negative aspect for its energy security, but as the data in Table 2 show, many countries have similar or even worse level of energy self-sufficiency. The problem is that Ukraine imports energy resources, mainly natural gas, from one country. This makes Ukraine dependent in her energy balance. Ukraine considers this circumstance challenging, as the Russian Federation formally proclaimed energy policy to be a tool for achieving geopolitical interests.

World Energy Council has been gauging and compiling national rankings of energy sustainability since 2011. An index of a country is created on the basis of the world energy triple nature consisting of energy security, accessibility of energy for the population (level of electrification of a territory) and environmental status of power sector. Ukraine in 2013 was in 97th position out of 129 countries (overall score was BCD). WEC experts point out in their commentaries that Ukraine's economy's energy intensity and amount of carbon emissions are among the highest in the world. The reason for that is quite large share of fossil fuels in this country's balance of electricity.

The experts believe that the energy sector of Ukraine faces difficult problems like the need to import expensive fossil fuels and undeveloped infrastructure and markets. They deem that energy efficiency policy should be enhanced and renewable energy potential should be used more for thermal energy and electricity

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generation, especially biogas and municipal solid waste. The experts trust that consumption of gas should be reduced in centralized heating and heating should be provided at lower cost. All these issues curb Ukraine's progress and her reaching yet higher level in the energy sustainability ranking.

Table 2

Indicators of dependencies in supplies of energy resources

Country or territory	Coal		Oil and oil products		Gas		Total consumption of energy	
	<i>tho. t n. e.</i>	%	<i>tho. t n. e.</i>	%	<i>tho. t n. e.</i>	%	<i>tho. t n. e.</i>	%
OECD	<u>124 778</u> 1 130 273	11,0	<u>1 392 652</u> 2 249 000	61,9	<u>291 640</u> 1 211 440	24,1	<u>1 812 809</u> 5 547 596	32,7
Belorussia	<u>83</u> 630	13,2	<u>5 577</u> 7 405	75,3	<u>16 699</u> 16938	98,6	<u>22 707</u> 26 590	85,4
France	<u>13 649</u> 14 421	94,6	<u>94 181</u> 91 441	100,0	<u>40 709</u> 40984	99,3	<u>143 298</u> 275 970	51,9
Germany	<u>25 716</u> 81 689	31,5	<u>123 464</u> 123 402	100,0	<u>65 715</u> 80 833	81,3	<u>214 469</u> 344 746	62,2
Poland	<u>- 12 990</u> 54 612	- 23,8	<u>22 161</u> 22143	100,0	<u>8 529</u> 12 231	69,7	<u>16 677</u> 92 969	17,9
Russia	<u>- 45 502</u> 117 069	-38,9	<u>- 338 155</u> 141 402	- 239.1	<u>- 151 393</u> 366 172	- 4163	<u>- 536 566</u> 686 757	- 78,1
Ukraine	<u>2 629</u> 37 289	7,1	<u>9 544</u> 14 762	64,7	<u>48 250</u> 67 445	71,5	<u>59 704</u> 143 237	41,7

Source: International Energy Agency.

Ukrainian Energy Index rating shows energy efficiency indicator for Ukraine to be 54,2% of the EU average [12]. Energy efficiency of Ukraine's industrial sector is 51,1% of that of the EU, agriculture – 37,1%, service sector – 46,1%, construction – 11,3%, residential sector – 61,9%. Energy efficiency rating of Ukraine's regions is topped by Transcarpathian, Chernihiv and Vinnytsa regions, whose energy efficiency indices are respectively 64,3%, 63,8 and 62,9% of the EU level. Energy saving potential of Ukraine is 26,5 mln t n.e. equivalent to approximately 29,3 bln m³ of natural gas. Potential energy saving amounts in money terms to 11,4 bln euros (in 2010 prices). Industrial and residential sectors have biggest energy saving potential as they are largest consumers of energy resources. Shares of industrial and residential sectors in energy saving in Ukraine are 48,0 and 34,9% respectively. According to some estimates, energy efficiency provides about 60–65% of economic growth of economically developed states. One percent of GDP growth brings only 0,4% growth of energy consumption.

Energy intensity of Ukraine's GDP was reducing before economic crisis of 2008. But this dynamic was not a result of dedicated governmental policy of energy efficiency support and neither a manifestation of market factors like price

elasticity of energy consumption. The other factors were more essential, for instance the factor of the economy of scales and reduction of operational costs in the costs of production. Diminution of the share of energy costs in the costs of manufacturing of some products and services was the result of rather limited number of energy saving projects of industrial modernization. This is an evidence of the lack of any radical or systemic effort in Ukrainian government's policy of energy efficiency and of inconsistency of economic mechanism for implementation of that policy.

A place of a nation in energy economic and energy ecological context of sustainable development depends mainly on the structure of energy balance, comprising electricity one, and on the level of energy technologies (like burning organic fuels). Ukraine's energy balance's structure is close to average European, but her energy efficiency technologies are yet lagging behind significantly. Ukraine has needed intellectual and resource potential to develop modern energy technologies up to European standards of energy efficiency, but she does not use organizational and financial backing. The mechanisms of the Ukraine-EU Association Agreement can be applied to bridge technological gap between Ukraine and the EU. A mechanism for Ukraine's participation in joint research programmes and technological platforms comes to mind in this respect.

European integration is an important walk of reform in Ukraine's energy sector, instilling a different type of relations going beyond the sector itself.

Ukraine's advantageous geographic situation is an important requisite for her integration into Eurasian energy space. Our country plays significant role in the safety of supplies of energy resources from Russia and Central Asia to the EU countries. It is imperative for strategic national interests of Ukraine to turn this benefit into competitive advantage of Ukraine's economy.

There are a few key demands to the EU candidate countries in energy sphere: improved energy efficiency; upgraded energy safety; strategic stockpiles of oil and/or oil products; restructuring of coal mining (preservation of coal deposits); better safety of nuclear power plants or their shutting down if that is not achieved); wider use of renewable energy; creation of energy market and independent regulatory authority; elimination of subsidies and price disproportions in energy sector; energy strategy of a nation adapted to energy policy of the EU.

Ukraine is one of the countries that signed and ratified the Agreement for Energy Charter, that is an important tool of energy security and stability of energy resources supplies in Eurasian continent. Energy Charter regulates commercial relations between the countries importing and exporting energy resources. Conditions and rules of commerce set in Energy Charter are in compliance with conditions and rules of the WTO. This means that Ukraine has for some time been operating in the world (and European) market of energy resources in compliance with the rules of the WTO. But emergence of competitive world market and liberal trade in energy resources is made more difficult by merely declarative support of Energy Charter by some exporting states (Algiers, Norway, Russia and others). Thus Ukraine's negotiations with Central Asian countries about transit of

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contracted amounts of natural gas (for example from Turkmenistan) are made more complicated because of Russia's reluctance to ratify Energy Charter and its transit protocol.

Ukraine has made a number of steps to reform its gas and electricity market in compliance with the Memorandum of Understanding on collaboration between Ukraine and the EU for 2009-2010. Promulgation of the act "Principles of Operation of the Market of Natural Gas in Ukraine" was of the most prominent among them. The act was aiming at approximation of Ukraine's legislation with the key laws of the EU regulating relations in the market for gas. As a result, Ukraine entered into the Agreement about the foundation of the Energy Community by signing a protocol to it on 24 September 2010. Having finalized all its domestic procedures Ukraine from 1 February 2011 became a member of the Energy Community in its own right.

Ukraine's taking part in the Energy Community gives outstanding advantages to her energy sector. As a party to this organization Ukraine must abide by the legislation of the European Union. The mechanisms are allowed the main goal of which is to improve safety of supplies, creation of certain stable regulatory and market structures. It also comprises coordination of mutual help in case of network failures. It could facilitate common commercial policies in energy realm. In compliance with the Protocol on Ukraine's joining the Agreement on Foundation of Energy Community our country has harmonize her laws with the energy sector laws of the European Union. To do so Ukraine must gradually implement the directives and rules of the EU in the realms of electric power and natural gas, as well as protection of environment.

To comply with the commitments taken under the agreement establishing Energy Community, Ukraine's State Agency for Energy Efficiency and Energy Saving prepared National Action Plan on energy efficiency to the year 2020, as set by the European Parliament and Council Directive 2006/32/EC of 5 April 2006. The goal at the national level is to achieve 9% energy saving of the average end consumption by 2020. To fulfil the European Parliament and Council Directive 2009/28/EC of April 23 the State Agency for Energy Efficiency and Energy Saving is also developing a draft of a National Action Plan on renewable energy until 2020 setting measures to implement Ukraine's commitments to the Energy Community to bring proportion of energy generated from the renewable sources to not less than 11% of aggregate end consumption of energy resources. This is equal to 8,53 mln t n.e. with larger share of it (5,85 mln t n.e.) to be in alternative energy in the heating and cooling systems.

Ukraine-EU Association Agreement broadens cooperation in the energy sector set by the agreement that founded the Energy Community in 2005. In case of a conflict between these two documents provisions of the Energy Community agreement of 2005 will prevail. Ukraine's joining the Energy Community and implementation of the economic part of Ukraine-EU Association Agreement determine complex economic reforms in the energy sector with the scope to further integrate Ukraine into European energy space.

According to the protocol on Ukraine's joining the agreement about establishment of the Energy Community, the Second Energy Package ought to be accomplished by 1 January 2012. But commitments assumed under the directives of the Second Package have only been partially fulfilled. There is yet no clear position on Ukraine's stance on implementation of the Third Energy Package supposed to be implemented in its larger part by 1 January 2015. As is known, the main demands of the directives of the latter Package is partitioning of the market of natural monopolies (electric power and natural gas) into the segments of generation, sale and transportation, and the demand of non-discriminatory access to energy networks. It is important to note that in contrast to the Second Package this principle should also be applied to the ownership rights.

Ukraine's geopolitical choice of eurointegration in 2014 worsened at the same time her energy security. The author deems orientation towards specific types of energy resources and development of selected sub-sectors of the fuel and energy sector of Ukraine to be common flaw of the first and second versions of Ukraine's Energy Strategy 2030. Market principles and mechanisms of adaptation of the structure of Ukraine's energy system to possible risks in the periods of crises were ignored. A new version of the Energy Strategy of Ukraine should be oriented toward achieving acceptable level of energy security and practical accomplishment of Ukraine's geo-strategical choice of integration its energy supplies system with that of the EU. Although energy strategy of the country should be made a priority of the Energy Strategy, its writers should also take into account the need of socio-economic development of the country to be sustained by technologically reliable, safe and economically viable and ecologically friendly way of fuel and energy supplies so that Ukrainian society continues to live normally in the circumstances of different calamities and perils.

Setting strategic milestones for Ukraine's socio-economic development to 2035 is going to enable her to set the parameters of the energy strategy. On one hand, development of the FEC should not restrain economic and industrial growth with unjustified growth of prices of energy resources and drawing of public funds that can be used for investments for subsidies instead. On the other hand, economic growth becomes in itself a requisite of accumulation of capital and thence modernization of FEC. That is why it is important to approximate priorities of economic and energy strategies of Ukraine with the latter being derivative of the former and be adjusted continuously.

So, with these trends and aspects in mind, the strategy of energy support of an innovative model of Ukraine's economic growth requires a structure and investment action of some kind. In the next few years the main portion of investments will go into prolongation of the terms of use of main energy infrastructure and reliability of energy resources supplies, in other words into the maintenance (accelerated amortization, control of the use of amortization fund for intended purposes and optimization of structure of generation of electricity, i.e. use of excessive capacity). Tariff policy should not be counterproductive and bring about reduction of operating costs of energy enterprises and options

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for modernization of priority infrastructure of energy sector that is owned by Ukrainian government by privatizing them and extending them tax credits for investments.

Investment and innovation path of Ukraine's economic growth is determined by the energy strategy of the nation based on the concept of innovative development of FEC through the formation in Ukraine of competitive markets for energy resources. It is obvious for Ukraine that innovation should be a basis for modernization of remaining technological processes and competitive structure of her markets benefits innovations better than that of monopoly. Energy sector creates primary demand in the market of consumer products, on the other hand it creates "conclusive" demand in the investment market and that is a global contradiction of economic recycling.

Modern times have been marked by price peaks and intensified competition in the world market of energy resources causing revisions of structural proportions of energy balances of the nations importing energy resources and hence making adjustments to energy policies through maximal improvement of the energy efficiency, increase of the proportion of alternative energy resources and diversification of energy supplies. Radical structural reforms in every segment of energy policy of Ukraine should be the most adequate response to modern internal and external economic challenges for her energy sector. These reforms should include energy efficiency, liberalization and integration of energy markets, fulfillment of the programme of increasing the share of renewable energy sources in the energy balance of Ukraine. Energy efficiency might be turned into a real resource for overcoming Ukraine's crises, her stabilization and passing to an energy efficient paradigm of economic growth.

Challenges facing Ukraine's energy policy are secondary problems, the offshoots of some of the aspects of the process of transformation of energy sector and of sectoral structure of Ukraine's economy. They are also the side shoots of the global geopolitical and economic tendencies in the world market of energy resources that have undergone substantial changes over the last decades. The reply of Ukraine and the other industrially developed countries consists in reviewing her national energy strategy, whose main principles are now debated in Ukrainian expert circles.

Further steps to acquire maximal energy independence for Ukraine remain a ticklish task for the government. The draft Plan of Priority Measures of the Cabinet of Ministers of Ukraine envisages the increase of the output of natural gas up to 27 bln m³ [13]. This will fully satisfy Ukraine's internal demand. As the document mentions, "Ukraine as a member of Energy Community has fulfilled the requirements of the Third Energy Package concerning liberalization of the market of natural gas in the part of primary institutional support. – **Author.**). Entire liberalization and demonopolization of the market of natural gas requires monopolies break up according to their activities. Development of the market of natural gas in Ukraine is not possible unless National JSC "Naftogaz Ukrainy" is restructured." The document says that the break up into the branches of transportation of

natural gas, its extraction, supply and other activities is very much needed for energy security of Ukraine. The government believes that such measures as liquidity of the market of natural gas, restructuring of the National JSC "Naftogaz Ukrainy", organization of reverse supplies of gas from the EU countries and development of the legislation that would create a gas hub in Ukraine are the key steps along Ukraine's path to her energy independence.

Conclusions

Key drivers of tectonic shifts in Ukraine's energy balance in 1991-2016 were the break-up of the energy system of the nation, uneven industrial output reductions and growth in various branches of Ukraine's economy and following fluctuations in the demand for energy resources, inconsistency of reforms in some markets of energy resources. These have had imbalance in the logistics of Ukraine's energy sector (energy, financial, information flows) as their outcome.

Analysis of the structural and price disproportions of the energy balance of Ukraine demonstrates that market mechanism does not guarantee optimal distribution of resources at the current stage. Existing structure of primary consumption does not correspond to the resource potential of the nation. The share of fuels that are not in strong supply internally in Ukraine has increased. At the same time supplies could not be diversified by turning coal into other types of fuels or increasing alternative or renewable sources of energy originating in Ukraine. This was the result of differing approaches to the creation of competitive structure and pricing mechanism for energy markets that could facilitate gradual approximation of supply and demand in Ukraine's energy market and optimize entire structure of Ukraine's economy. Distortions in the markets at the very stage of their emergence disfigures the purposes and results of their operation thus devaluing the effect of the transfer of property rights.

There have not been any national scale breakthroughs (with only few exceptions) in modernization of Ukraine's assets and improvement of efficiency of production despite privatization of her energy and industrial enterprises. The scale of private financial and industrial business has increased and their impact on the other branches of economy increased too strengthening therewith market power of energy monopolies. That is to say that privatization in itself without competitive market infrastructure and relevant institutional environment has not created in Ukraine any stimuli for development of innovations and investments. Regulatory policy of Ukrainian governments boiled down to administrative control of prices, handing out preferences and subsidies to some financial and industrial interests and approximation of the interests of public monopoly companies with the new players in the markets. Asymmetric market information levels down the government's anti-monopoly policy, invokes certain technological and transaction costs that are passed on to the consumers who in their major part are unable to uphold their economic sovereignty.

Overview of eurointegration of Ukraine in the energy realm manifests our country's sharing and perceiving European principles, goals and criteria of sus-

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tainable development of energy sector, but she does not apply European methods of solving the tasks. This is relevant, for example, in the domain of transparency of her policies, of reaching a consensus among all the stakeholders, mechanisms of planning and forecasting (modern systems of decision making and risk management, energy foresight, technological platforms), responsibility for untimely execution of plans and inefficient management, insufficient coordination among governmental agencies (duplication of functions), public activation of energy policy (involvement of the public), etc.

It can thus be foreseen that the EU will thither be much more thoroughly considering the options of Ukraine's integration into European energy system thanks to a number of factors. First, Ukraine herself is a large consumer of energy resources and structure and industrial orientation of manufacturing sector will not change significantly. Second, the structure of Ukraine's energy system is not balanced in its capacity to regulate the schedule of electricity flows, neither its generating facilities are to European parameters. Third, neither Ukraine, nor the EU will have in the foreseeable future free investment resources sufficient to radically change the structure, technological level and resource base of Ukraine's energy sector. One can hope though that collaboration between Ukraine and the EU in energy realm would contribute to the harmonization of institutional, technological, organizational and financial tools of implementation of joint energy policy of sustained development that is a key venue for Ukraine-EU integration.

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